Read Warfare on Flies Chem

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Pure or Applied?

➤ FOR SEVENTY YEARS a chemical sat on the shelf. It was an interesting chemical. Its original synthesis had been a good research problem, involving substitution of chlorine for hydrogen at several different points in the structure of the molecule. As time went on, different methods of its synthesis were attempted, for no reason except to see whether it could be done. As a result, much information of value in synthesizing other compounds was accumulated and the science of chemistry was advanced.

The chemical itself, its distinguishing data once recorded in the ponderous lists that chemists have to keep, became only one more among the myriad white powders that only an organic chemist can love.

So we find it, or almost find it, among the classical reference works, in the series of compounds derived from diphenyl ethane. At the time that those reference works were compiled, the goal of the synthesizers was new dyestuffs and their sinister unacknowledged cousins, the high explosives. Less thought was given to chemicals for the ways of peace. So, since dichloro-diphenyl-trichloro-ethane wouldn't explode, nobody gave much thought to finding out what it could do. This is known as "pure" research.

Now the unappreciated chemical turns out to be the answer to one of humanity's oldest problems—how to get rid of flies. Two properties make it particularly effective for this purpose. It is many times as poisonous to insects as to warm-blooded animals, and it can be applied to the insects' favorite haunts, so that it will be picked up by them whenever they come that way again. This, it seems to us, is one of the best kinds of "applied" chemistry.

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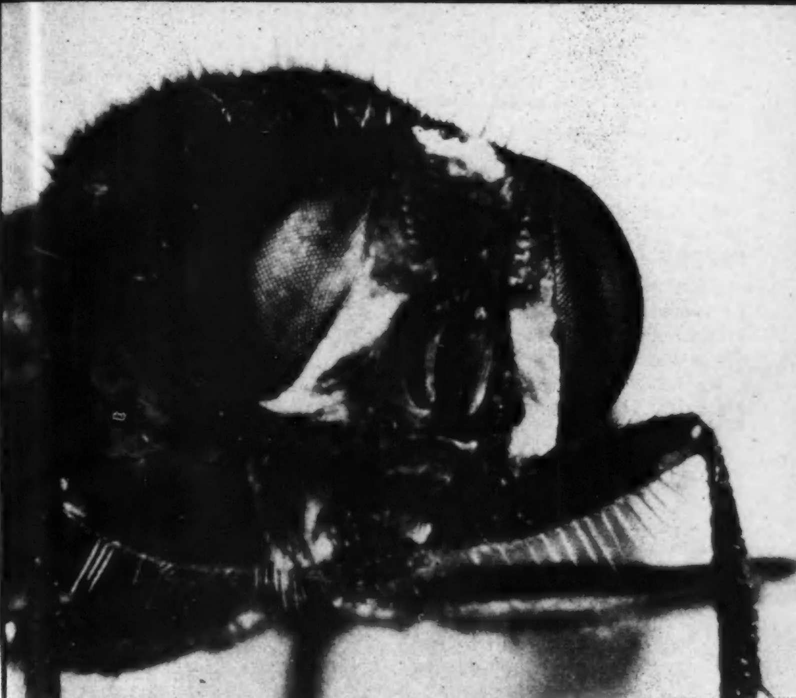

FACE TO FACE *with the enemy: magnified view of head and foreparts of female housefly. If flies were as big as this we wouldn't have tolerated them for so many years.*

Chemical Warfare on Flies

by DR. FRANK THONE

WAR HAS BEEN DECLARED upon flies. It is war to the death—of the pesky flies. Throughout the nation, people by the millions are joining in a great country-wide anti-fly campaign, to make the fly virtually extinct.

Never before has man had the ammunition to fight a winning battle with the housefly. Now that DDT is available and we know how to use it, any community can be made virtually free of flies.

The common fly stands indicted by health and medical authorities for:

1. Flies are a menace to public health.

2. They carry germs straight from the filthy places in which they breed and feed to the food that you eat.

3. They spread dysentery and other dangerous and troublesome diseases.

4. They are a general nuisance, disturbing the sleep of old men and little babies, worrying everyone with their buzzing, plaguing animals so that cows produce less milk and cattle don't gain weight.

Every fly that zips by your nose is an insult to the human race. Once scientists gloomily predicted that the insects would inherit the earth from humans. Now they have changed their predictions.

A plague of flies will never come to your town again if you and your neighbors join in the war on flies.

In a few American communities it has already been proved possible to make the common housefly the rarest of all insects. By concerted action, and at no great expense, citizens of those cities have made the housefly virtually as scarce in their streets as a dinosaur or a dodo.

At a recent meeting of economic entomologists, incredible tales were told, of restaurants and soda-fountains with their screen doors left standing wide open all summer long, of a scientist who was unable to catch enough flies for experimental purposes even when he set up his traps at a local slaughterhouse.

These men, who only a few years ago were talking gloomily of man's losing fight against insects, have changed their viewpoint most radically. Now, they hold, thanks to new insecticides and new tactics, man is able to counter-attack with real hope for success. He can control or exterminate any species of insects important enough to make the expenditure of effort and money worth while

It is possible for every housekeeper to make her house her castle, and within this screened stronghold maintain a practically complete freedom from flies. Spray-gun and fly-swatter have been effective weapons in this individual warfare for quite a long time, and the postwar addition of the DDT aerosol bomb has tipped the balance even more decisively against the fly.

However, if a whole town is to be made as free from flies as a well-kept modern living-room, this house-by-house defense must be converted into a vigorous offense, with everybody joining to down the fly wherever he may be, and special corps seeking him out in the places he comes from, and seeing to it that he never gets started from there.

Begin at Home

➤ THE WAR on flies must begin at home.

DDT attack on flies, and the clean-up of fly breeding places, can be conducted at any level. The individual householder can do battle on his own premises, the people of a neighborhood can create fly-free islands, or everybody in the whole town can be lined up for a city-wide crusade that will exterminate all the flies within the city limits.

It is even possible to extend the slaughter out into the country and practically rid an entire state of flies; Idaho did that last year, and eight or

ten states in the West and Midwest are following through on good beginnings they also made in 1946. It all depends on community spirit and organization.

For the individual householder, the weapons are those of the infantryman—simple, relatively small, but adequate for the purpose. The handy aerosol bomb is a good means for immediate riddance of flies that have already gained entrance despite tight screening. The best way to use it is to shut windows and doors of the room where the flies are, open the nozzle of the bomb and swing it around for five or ten seconds. Then slip out of the room and leave the door shut for about a half-hour.

So little DDT is released in this ultra-fine mist that there is no danger in breathing it. As a matter of precaution, however, food and dishes likely to be used for food should be removed or covered before spraying. Also, if you have a fish-bowl in the room, either take it out first or cover it until the spray has settled. Gold-fish and tropicals are much more easily affected by DDT than are warm-blooded animals.

Don't be alarmed by the peculiar, pungent odor given off by some aerosol sprays: that is due mainly to the solvent oils.

Killing a few flies with an aerosol spray, however, is merely a skirmish, not the whole battle. Real hostilities call for the use of slightly heavier weapons, spraying stronger DDT solutions. The ordinary hand spray pump is sufficient for one-house fly-fights; it should be loaded with a solution containing not less than 5% of DDT. Some of these are sold already mixed. You can also buy DDT concentrates (usually on sale in the same stores) and dilute them according to directions with odorless kerosene.

These 5% DDT sprays, since they are almost always in kerosene, should be used with the same precautions that would be observed if you were spraying with straight kerosene. That is, they should not be squirted on delicate drapes or light wallpaper that will show a kerosene stain. They are apt to damage some kinds of varnish, but can be sprayed on painted or enameled surfaces and on glass or metal without harm.

They do not need to be sprayed all over the place, but only where flies congregate in the daytime or roost at night. That will usually mean porch ceilings and the areas around screen doors, where flies alight to await their chance for an entrance. Indoors, probably only the kitchen ceiling will call for a spraying of this kind—of course, after foods and dishes have been stowed away or covered. Surfaces should be sprayed only until they are damp, not to the point where they are completely wet, with the solution running off in rills.

Some areas can be better and more economically treated by applying the solution with a paintbrush than by spraying. This is especially true for screens. Paint both sides of the screen door, and window screens, frames and all. Paint also electric fixtures and lamp drop cords, for these are favorite roosting-places for flies.

This spraying and painting with 5% DDT solution is for what is known as residual effect. After the

solvent has evaporated, it leaves behind an invisibly fine deposit of the white DDT crystals. If a fly rests or crawls for a short time on these minute grains of death, he is as good as done for. He may buzz off as if nothing had happened, but at least a few particles of the DDT will stick to his feet, and presently reach the nerve-endings. Once DDT has contacted nerve tissue, its paralyzing effect begins. By and by it reaches the nerve centers in his body, and he goes into the "double delirium tremens" that prelude his unlamented demise.

One tactical trick in your spraying with DDT can take advantage of flies' tendency to roost on anything from which they can see in all directions. Their ability to take an all-around view of the world is made possible by their remarkable eyes.

Here is the trick you can play on them: Dip lengths of net cord (that hard twine, stronger than ordinary string) in DDT solution—the stronger the better—and after they have dried, hang them from the ceiling. Or stretch longer pieces of similarly dipped cord horizontally from wall to wall, attaching them to the picture-molding or the tops of windows. Flies will not be able to resist these alighting places—and every fly that alights will surely die.

Another good place to brush or spray with over-strength DDT solution is a zone just below the lid of your garbage-can. This will get not only flies but other "garbage-bugs" that swarm on this threshold to a free-lunch counter. If you have a dog-kennel out in the yard, give that a good spraying inside and out. It will get a lot of fleas, as well as the flies that usually hang around. And if you are suburban enough to keep chickens, give the hen-house a going over with residual spray—after first doing a thorough scrape-up, clean-up job.

One solid warning, never to be neglected while using kerosene-dissolved DDT sprays, as well as some of the emulsions: keep away from fires and lights of all kinds. Don't smoke while spraying. If your kitchen gas-stove has a pilot-light, put it out while the spray is in the air, and light it again when the job is finished.

Don't get any more of the kerosene-dissolved spray on your skin than you can help. If you do get it on your hands, wash them thoroughly with mechanic's soap when the spray job is finished.

Okinawa Was First Victory

➤ DDT IS THE DECISIVE weapon in the war between man and flies.

Clean-ups of breeding and feeding places have been used in the past, supplemented by traps, sticky flypaper, swatters and earlier types of poison sprays. These weapons were not adequate for the job. Clean-ups plus the older weapons merely abated flies more or less—usually less. Clean-ups plus DDT mean total extermination for flies wherever the two are used to the fullest extent of the community's will and ability.

This is no idle claim. It has been tried, and results prove that it really works. Last summer the clean-up-plus-DDT combination was used in a

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▸ Home defense *comes first. Besides spraying ceilings and other roosting-places for flies with residual-type DDT, it is a good idea to paint screens and screen doors with the same kind of solution.*

number of towns, especially in the livestock and dairy states, with results beyond the belief of anyone who has not actually seen what happened.

One of the most spectacularly successful of these communities was Moscow, Idaho, where the state university is located. By the time the campaign had really got in its licks, flies were scarcer in Moscow, Idaho, than avowed czarists in Moscow, Russia. Restaurants and ice-cream parlors propped their screen doors wide open and left them that way all summer long. Fly-swatters would have gathered cobwebs, only all the indoor spiders that might have spun them starved to death. A professor at the university, who wanted a few flies for experimental purposes, set a trap by the door of the city's one slaughter-house, and another by a collection of garbage-cans. The traps stood there, empty, for three weeks before the scientist gave it up as a bad job.

Most of the communities that carried out fly eradication campaigns last summer were smaller cities and country towns, where cooperation was easier to enlist than it might be in a big city, and where there were fewer problems such as will be encountered in really extensive slum and industrial areas. Yet there is no real reason why places as big as Los Angeles or Detroit or New York should not rid themselves of flies. It would be really something for a metropolis to be able to brag: "Two Million People and Not One Fly."

The DDT phase of the combat, like the clean-up phase, can be carried on at any level, from the individual house to the whole city, plus suburbs and satellite towns. Caliber of weapons can range from the hand-operated spray-gun or one-pint aerosol bomb to power-operated outfits with barrel-size tanks for the DDT solution, that will treat the interiors of whole barns or warehouses.

Even larger-scale weapons have been used, under special conditions. Airplanes distributing DDT sprays are becoming commonplace where mosquito abatement is called for over a whole swamp or lake shore area, as well as against gipsy moth, European corn borer and other forest and field pests.

Airplane spraying was used against flies that swarmed over some of the Jap-occupied islands during the Pacific campaign, beginning with Okinawa. Flies had been thick over previously invaded islands, breeding and feeding on enemy corpses, scattered food wastes and general filth. Casualties due to diarrhea and the dysenteries ran high.

When the carrier-based planes gave Okinawa its first taste of American bombing, every sixth plane laid down a blanket of DDT spray. The same was done before the landing at Iwo Jima. Result: instead of the expected 10,000 or more cases of diarrhea and dysentery, there were barely 100.

Flies were a terrible nuisance during the early work on Bikini, in preparation for the atom-bomb tests last year. A general airplane treatment with DDT reduced their numbers to insignificance. (As an interesting sidenote on the spread of civilization, the brown-skinned natives of Bikini, removed to another atoll for safety, had only two requests to make in response

to a later inquiry; they wanted toilet paper and some more DDT!)

Wholesale spraying or dusting of American cities from airplanes, to get rid of flies, is not considered either necessary or desirable by most scientists. Entomologists in the U. S. Department of Agriculture, in especial, are against it partly because of its wastefulness (DDT isn't cheap), partly because of the harm it might do to bees and other beneficial insects. They say this is an operation for the ground forces, not for planes.

The use of DDT in your campaign will harm no bees or other useful insects, because the DDT will be sprayed and brushed where flies go but bees do not. It may knock off a few house-centipedes or spiders, which do have a useful role as enemies of flies; but since most housewives have a squirmy dislike for these many-legged creatures their loss can be taken philosophically. They're going to lose their jobs, anyway, with the disappearance of flies.

Neither will DDT harm songbirds, since very few of them are fly-eaters. Moreover, songbirds are usually not found in neighborhoods where flies congregate—and where they will die this summer.

Unappreciated for Seventy Years

➤ THE SENSATIONAL CHEMICAL, DDT, which makes war on flies possible, was made chemically and lay around unused for over 70 years before it became the world's No. 1 insecticide.

DDT was first compounded in Germany in 1874, but nobody did anything with it. Then, shortly before World War II, it was given a trial in Switzerland, as a possible substitute for arsenical insecticides for the protection of wine grapes. It was also tried against the American striped potato beetle, which has got a foothold in Europe. It worked well against both. The Swiss firm, J. R. Geigy, A. G., of Basel, took out patents on its insecticidal uses and undertook its manufacture.

When the United States was blown into the war by the Pearl Harbor attack, it became highly desirable to find a substitute for the arsenical insecticides that had always been used, because arsenic, copper and lead, three of their principal ingredients, were urgently needed for various military purposes. Also, and perhaps even more urgently, a really effective pediculicide (louse-killer to you) was wanted, partly to relieve GI's of the "cooties" that were the curse of World War I, partly to avert the menace of louse-borne typhus among the war-stricken, crowded populations of northern Africa and southern Europe.

In the hands of U. S. Department of Agriculture entomologists, DDT showed up well in all tests. Limited supplies went for experimental work on farms and in orchards, but the bulk went to the fighting forces. The way it put the brakes on a rising typhus epidemic in Naples, shortly after the city's liberation, is now a classic in military medical history. It made the work of malaria mosquito and dengue control easier in the later fighting in the Southwest Pacific theater. Of its use to make whole islands fly-free we

have already taken notice. When the shooting stopped, the American civil population eagerly awaited an opportunity to turn this new weapon against some of the buzzing, crawling pests that make life uncomfortable and food-raising unduly costly.

While DDT definitely is poisonous to human beings, it may be used without fear of ill consequences if proper precautions are observed. Bottles or cans of the solutions commonly employed should be kept out of the reach of children. Light sprayings need no special precautions because so little DDT is released.

It must not be thought that DDT is the only new synthetic insecticide that amounts to anything. On the contrary, there are any number of good ones. British chemists looked up another victim of decades-long neglect, a compound that is especially deadly, known variously as benzene hexachloride, 666 and Gammexane. The latter word is the British-convenience-name for it, and the 666 refers to the fact that its molecule contains six atoms each of carbon, hydrogen and chlorine.

The properties of DDT itself can be modified almost indefinitely, by adding more chlorine atoms, or by substituting for part of the chlorine one or another of its chemical relatives, bromine, iodine, or fluorine. There is also a whole group of killer-chemicals, each the favorite of some producer, tradenamed Lethane, Velsicol, 1068, Octa-Klor, Dithane, Thanite, Toxaphene, and so on. Many of these have real merit.

Some of these, however, have not yet passed the experimental stage (when you deal with poisons, tests must be careful); others have been well tested but are not yet in large-scale production. Still others are being produced, but the whole output is in demand for special uses, particularly the control of farm, orchard and forest pests. To sum it all up: DDT is the best fly killer yet developed and for this season, at least, the one first-class fly-killing chemical abundantly available everywhere is DDT. The anti-fly campaign of 1947 must be waged with DDT as the main ammunition, with pyrethrum sprays and aerosols playing a part for quick knockdown indoors.

"Double Delirium Tremens"

➤ Any fly that steps on a far less than flyspeck-size bit of DDT, the anti-fly chemical, is doomed to death.

When a fly steps on even an invisibly tiny speck of DDT, or laps up a bit of it in his food, the first thing that happens is nothing at all. DDT is not a lightning killer. The fly sails around quite unconcerned, or creeps along on the ceiling or windowpane.

But in 30 or 40 minutes something does begin to happen. The fly seems a little less cocky and certain of himself. He moves hesitantly, staggeringly; his flights become shorter and seem a bit out of control. Presently he falls, unable to fly at all, and crawls around erratically, as if very drunk indeed.

It was this phase of the fly's troubles that induced some young entomologist to apply a new meaning to the initials DDT; he said they meant "Double Delirium Tremens." The fly certainly

does look as if he "had 'em bad." After a while he cannot even crawl, just lies on his back and kicks his legs feebly. Then he stops kicking. Mark up one "good" fly. Not only do flies die after contact with DDT recently applied. Their survivors continue to pick up deadly doses for four or five months after the spraying is done. That's one reason DDT is so effective and popular.

But many people want immediate results, especially when they are after flies clustering on the porch ceiling or invading the living rooms. They want to see them fall as soon as they are hit. For this reason, aerosol bombs usually contain pyrethrum as well as DDT. Pyrethrum, the active principle in old-fashioned Dalmatian insect powder, is extracted from the flower-heads of a daisy-like member of the chrysanthemum tribe. It was the only insecticide in most sprays in pre-DDT days. It does score a quick knock-down, but on many flies it fails to score a complete knockout. Eventually they revive and go back into business. That is why pyrethrum and DDT are teamed up for immediate-results sprays: one knocks 'em down and the other keeps 'em down.

Nobody knows yet why DDT is so extremely deadly to insects and less so to warm-blooded animals. The one thing that is definitely known is that DDT is a nerve poison; it induces a paralysis that in turn stops other life functions. But the exact lethal mechanism, the chemical reaction between DDT and the nerve substance that ends in death, has not yet been discovered, despite intensive research on the subject.

One sector of that frontier, incidentally, was explored by a brilliant young woman scientist, Marina Prajmovsky, who was top prize-winner in the first Science Talent Search, conducted by Science Service in 1942. She did her work as part of a project conducted at Harvard University under the general direction of Dr. J. H. Welsh, for the Office of Scientific Research and Development.

It is really too early to expect precise answers about the chemistry of death by DDT. The whole subject is still very new, and most scientists have been busy farther down the line, on DDT's immediate applications rather than ultimate reasons for its action.

The Rogues' Gallery

▶ Flies aren't "just flies". There are several spicies of flies besides the housefly that get into houses. A brief glimpse at the marks whereby they can be told apart is worth while, if for no other reason than that it always pays to know your enemies.

The housefly, all too common, hardly needs description—although it is to be hoped that it may soon become so rare that you will have to go to museums to see dead specimens. Its body, about a quarter-inch long, is dull grayish with darker gray stripings. Males can be distinguished from females (if you're that curious) by two characters. Their large compound eyes come very close together, or even actually touch, while the females have a distinct dividing zone between the eyes. Also, abdo-

mens of males have brownish sides, in contrast to the uniform gray of the females.

Houseflies often get the blame for one piece of villainy of which they are physically incapable. They are accused of biting. They have weak, "sponging" mouthparts and cannot bite. There is, however, a fly that looks a lot like a housefly and does bite. Besides this species there are occasional visitors from the domestic animals' quarters—either stable flies or horn flies. Both are shorter-bodied than the housefly, and darker in color. They are real blood-suckers, and their bites really hurt. They are, incidentally, fairly close relatives of the tsetse fly of Africa, notorious as the carrier of sleeping sickness.

More conspicuous than these are the blue-bottle flies, insects with a bright metallic sheen. Three commonest species have blue, green and bronze colors, respectively, but all are known as blue-bottles. They are primarily carrion-eaters, but are able to breed in other kinds of filth. Never as numerous indoors as houseflies, they are just as objectionable and should receive equally short shrift.

Insects that look a little like houseflies, but are somewhat smaller and have whiter markings, are often seen gathered in groups on the ceilings. These are known as cluster-flies. The residual DDT spray that gets the houseflies will also dispose of these uninvited guests.

Biggest fly ordinarily seen in houses is an occasional invading horsefly. It gets to be almost as big as a bumblebee, but is not gaudily striped like that insect. Its huge eyes, that almost entirely cover its head, shine with brilliant bands of ruby, purple and green. Horseflies are capable of inflicting severe bites, but as a rule the ones that blunder into the house are so nervous, swooping in endless curves around the room, that they take little time for biting. A whiff of aerosol spray will bring the horsefly down in short order.

In contrast, the smallest fly seen in homes is the little fruit-fly. This creature, not much bigger than a gnat, swarms over fruit that is not refrigerated, and will also patronize the garbage-can. Fruit-flies are especially sensitive to DDT and pyrethrum; a very little aerosol spray will get rid of them for several days. Since they come in the groceries, however, you will need to deal with them every few days. Fortunately, fruit-flies are not as foul in their habits as almost all other commonly encountered flies; they lay their eggs wherever they can find a little fruit pulp that is beginning to ferment; hence their other names, vinegar-flies and pomace-flies. Because they are easy to keep, and because they show sharply-marked hereditary characters, fruit-flies have become the standard experimental material of geneticists.

Less frequent visitors, but causing some alarm when they do appear because they look like giant mosquitoes, are the slim-bodied, long-legged crane-flies or gallinippers. They are quite harmless, since they neither carry filth to food nor bite human beings. It is just their hard luck that in their efforts to escape they will pick up some residual DDT on the window-screens.

These are the commonest flies and fly-relatives found in and around human dwellings. There are hundreds of

other fly species, some of them of economic importance, some of little significance one way or the other, and some even allies of man, for the wasp-like robber-flies pounce on other insects like hawks. But all these are flies of the out-of-doors, and not of importance to this summer's war.

How to Fight Flies

➤ THE WAR ON FLIES won't be successful if it is fought only in the homes of the city.

Stores, restaurants, markets, milk depots, suburban cowbarns, dumps and slums must be included in the battle-ground.

In doing some of the larger DDT spraying jobs needed in the anti-fly campaign, it may be necessary to adopt that time-honored American procedure—voluntary cooperation of neighbors. Fortunately, the apparatus needed for these larger spraying jobs is not highly specialized. Any sprayer—knapsack-type, barrel-type, or a more ambitious job with a small gasoline engine to raise the air pressure—will do the work, if there is a good nozzle that throws a good spray, but not a fog. Best of all is a nozzle that throws a spray in a flat fan-shape, for this can be wielded like a paint-brush, either flatwise to cover surfaces rapidly or edgewise to intensify the effect on some particular angle or post.

When preparing to make a store or restaurant fly-free for the summer, it is best to start after closing time. All foods must be put away, all food utensils either stowed or well covered, and the furniture preferably stacked and covered with paulins, or at least wide strips of paper. The spray need not be sloshed indiscriminately all over the place; as a rule, the ceiling and upper two or three feet of the walls will suffice. Spray should come lower where flies habitually come lower, as in the food-preparing areas — again being sure that food and utensils are not there to be contaminated.

For the average retail establishment, as for the home, the most convenient method of applying DDT is as a 5% solution in light kerosene. The same rule about density holds: enough to make the surfaces noticeably moist, but not enough to make them runny-wet. The oil spray will not harm painted walls or most kinds of wallpaper—it may stain some light blue or green wallpapers. It should not be used on calcimined walls, since it causes calcimine to run. Neither should it be used on freshly whitewashed surfaces: the lime destroys DDT's effectiveness.

The small cow-and-chicken enterprises, typical of city fringes, should come in for thorough treatment with a good residual spray—after, of course, a clean-up of breeding-places. It need not cover everything; ceilings, upper parts of walls, posts, stanchions and feed-bins are the places most frequented by flies.

A good going-over with residual spray on bushes, fences, and exteriors of buildings where cows are kept will be very helpful in disposing of the mean, little biting fiends known as stable-flies.

Be careful, though, not to do any spraying while milk or milking buckets are within range of the spray-gun.

A good, general rule: Watch where flies like to roost, indoors or out, and lay down a film of residual DDT spray. Any given fly will roost on that spot just once more.

Flies in Slums, Dumps, Alleys

➤ FOOD MARKETS, dairies, restaurants, ice-cream parlors and similar establishments have appropriate sanitary regulations and if these are observed there will be little trouble with flies. Moreover, if people become sufficiently fly-conscious it will soon be recognized by the managers that flies on the premises are very bad negative advertising.

One thing should be done: scout the alleys and back doors to these places. Sometimes lackadaisical hired help will toss spoiled fruits, vegetable trimmings and the like into a half-hidden corner in an alley, or among the weeds on a vacant lot. Or they will let spilled milk form little puddles, turning sour. Things of this kind, not tolerated in front of the shop, may happen at its back doors, and it is here that volunteer alley patrols can do much towards making an anti-fly campaign 100% effective. Or little delegations of determined women customers can request the privilege of a front-to-back inspection. The forehanded shopkeeper will be delighted to demonstrate how well-kept his service area is. If one or two have not been so forehanded, it can be taken as assured that they won't be caught with dirty, fly-haunted back steps a second time.

Special problems may come up because of the greater size of certain establishments, like packing-houses and canneries. Managements of such plants will almost invariably prove cooperative because they recognize the value of freedom from flies as a sanitary measure, especially in the handling of food. It will be nice to be able to advertise: "Foods From Fly-Free Factories!" They all have their own maintenance crews, who know the premises, and can be used in getting all fly-attracting surfaces treated with residual-type sprays. Spraying the outside of buildings, loading platforms and curbs and gutters near markets and other fly-attracting places is a big help.

Slum areas, with their open privies and their leavings of garbage, present the toughest problem. Little or no cooperation can be expected there, either from tight-fisted owners or dispirited occupants. The city government may have to pass a "you've got to" ordinance, which civic-minded groups will follow through, to see that it is enforced.

The real cure for fly-filled slums, however, is more radical than even the most thorough clean-up and spraying drive. To make an end of slum-bred flies it will be necessary to make an end of the slums. But Rome wasn't torn down in a day, and we'll have to do the best we can this summer, with the means at hand. Systematic spraying or fogging of streets and alleys by health authorities with motorized power outfits is justified and reasonably effective.

There are a few large buildings, of

the loft and warehouse types, that may be made fly-free without the necessity for going over all ceilings and upper walls, foot by foot, with hand-directed sprays. Two or three manufacturers have adapted the wartime smoke-machine to the purpose of sending out a "smoke" loaded with DDT. During the past year or so these have been used mainly to rid orchards of insect pests and to abate the mosquito nuisance around summer resorts. They can, however, be used for large interior spaces, so long as no food is exposed during operations. If such a machine is offered for use in a municipal fly-eliminating drive, a competent practical entomologist should be consulted before opening fire with it.

More vigilance is needed in the city's outskirts in the war on flies.

One is the city dump. No city should dispose of its garbage by dumping, now in the middle of the Twentieth Century, but it is regrettably true that some municipalities have not yet got round to providing themselves with incinerators or garbage-reduction plants. Where dumping of raw garbage is still necessary, about the only thing that can be done to abate it, within limits of most towns' economics, is to see to it that it is covered over with stuff that will not attract flies, such as cinders, and earth from excavations for new buildings.

Manure from livery and trucking stables used to be an offensive item in city dumps, the more so because of its proneness to spontaneous combustion, sending malodorous smoke into residence districts when the wind was wrong. This very seldom happens any more; where it does, the only remedy is to cover with ashes or earth such manure as is already present, and prevent any more from being dumped. It should be got onto the land and plowed under, for its fertilizer value.

Stockyards and slaughter-houses present a peculiarly difficult problem. Animals and their wastes always "draw flies," and cleanliness to the point of complete flylessness is difficult to achieve. Yet it is worth trying for, because a high proportion of the flies that hang around such places are not houseflies but blowflies and certain species that bite and suck blood. The biting flies keep the animals apprehensive and restless, and actually reduce their dressed weight. That a real clean-up around the slaughter-house, followed by proper use of DDT, can really abolish flies was proved last summer at Moscow, Idaho, when a screen-wire flytrap set alongside the door of the local abbatoir stood for three weeks without catching a single housefly!

Milk distributing points are often situated on the outskirts of cities. It is even more important to rid them of flies than it is to make the slaughter-house flyless, because of the risk of getting fly-borne germs, especially those of typhoid and dysentery, into the milk. Most dairymen realize the importance of this, and have done fairly well in the past, at least, so far as careful screening of all openings and good cleaning practices will go. Now, with the aid of DDT, they are in position to get rid of the winged hangers-on that have always come in from other places even when they could not breed on the premises.

Clean-up efforts cannot overlook the smallest places in which fly-breeding

wastes can lurk—it is certain that the flies will not. One storekeeper, for example, who prided himself on the scrupulous cleanliness of his premises, was nevertheless host to a certain number of flies around his back door. Close inspection showed that in brushing wastes across the alley, some of the finer material became lodged in the crevices in the stone-block paving, and there became fly nurseries. Grouting the pavement with a thin mix of cement stopped the nuisance.

Able aids to inspection committees of grown-ups, in seeking out and eliminating fly breeding places, can be found in the ubiquitous young folk. Members of science clubs, scouting organizations and the like will take a delight in showing their elders places that they have overlooked that are still yielding crops of flies.

Making your town fly-free is not an easy task, or cheap. It will require the cooperation of all citizens of good will, a certain amount of messy, smelly labor in cleaning up breeding-places, and a conscientious spraying job afterwards. It will require follow-through, to see that filth does not accumulate again, and perhaps a second spraying in certain places if the first residual deposit of DDT wears off and leaves the surface safe for flies late in summer.

It is quite possible to by-pass the most laborious and troublesome part of the campaign by skipping the clean-up of fly-breeding spots and merely giving them one or two fairly heavy sprayings. That will kill a lot of flies, and may give you a superficially flyless town. But if the filth remains the flies will come back. First the clean-up, then the spraying, is the formula for real victory over flies.

Facts of Fly Life

➤ An exact knowledge of the facts of life about flies is necessary if we are to fight them successfully. As with any pest, one of the best lines of attack is to find its breeding-place and destroy it, or at least neutralize it by making the production of new generations of flies impossible.

The fly's first choice of birthplace and nursery for its offspring is single and simple: a pile of horse-manure. If it cannot find that, it will accept several second choices—all of them filthy. It is evident, then, that we are not going to be able to be altogether "nice" in our discussion of where flies come from, and how to prevent the coming of more of them. We shall have to handle a smelly subject without gloves—or at best, with rough gloves suited for wielding a pitchfork.

When a female fly is ready to lay her eggs she follows her nose to the nearest manure-pile. Cow-manure and manure from other animals, mixed with straw, will do if horse-manure isn't available. An old-fashioned outdoor privy is another second choice high on her list. Not so good, though still capable of nurturing her young, are masses of fermenting vegetable matter, like refuse in the alley back of an untidy market, or sour garbage on a city dump.

Let no one smugly think that "in our fair city such fly nurseries just don't exist." It's a safe bet they do, though perhaps in places not often

visited by our most comfortable citizens.

True, the garage has replaced the family horse barn and the public livery stable, but increasing popularity of horseback riding as a recreation has brought the riding stable into practically every large and middle-sized city in the land. In suburban areas, especially the less exclusive ones, there will be plenty of family cows, or one-man, three-cow neighborhood dairies; likewise flocks of chickens, and (south of the tracks, at least) even pigpens. Very likely your town has a local slaughter-house or other food-processing plant.

And unless your town has been one hundred per cent de-slummed you can be very sure that in the huddled tenement districts inhabited by the very poorest and most handicapped there are still open privies, conveniently overlooked by politically obligated officials.

All these places, and others that local conditions may produce, give the fly a wide choice of spots where she may lay her eggs.

Finding a nice, fresh piece of manure, she deposits about 130 of them—little, pin-point things you would never notice unless you were an entomologist. In 24 hours or less they hatch out tiny larvae or maggots. Almost microscopic at first, they gorge themselves on the abundance of choice fare with which they are surrounded and after from three days to a week they have attained the half-inch of length that marks full growth.

Then they crawl to the edges of the manure pile, burrow into the soil, and change to the brown, barrel-shaped resting or pupal stage, while they develop within this case the legs, wings, compound eyes and all the rest of the body-parts that mark the adult fly. When the weather is warm, this process is completed in less than a week; in cold weather the pupae may rest for many weeks, waiting for a favorable time to emerge. Probably flies survive the winter in this resting stage, though perhaps some of the skulking survivors that hang around out-of-the-way places in houses and barns all winter long are also founders of the next year's swarms.

At any rate, after a week or two the infant fly has progressed from egg to adult, and is ready to make its first trip from the manure-pile to your dining table. When it emerges and dries its wings, the fly already knows all it needs to know to be a success from its own viewpoint. It doesn't have to learn anything; it has a full set of reflexes and instincts that will take care of it in all ordinary situations.

Presently it will meet its opposite, and will mate in the casual manner of flies. Thereafter the female is ready to deposit her first "clutch" of about 130 eggs, and during her normal lifetime of from two to 12 weeks will seek the manure-pile for egg-laying purposes from two to 21 times. No wonder that flies build up their numbers so fast when warm weather comes.

Remember that flies are good travelers, they may fly from slums 10 miles away to your kitchen table. This has been proved by entomologists marking flies and turning them loose, then recapturing them at various distances from the point of liberation.

Clean Up Manure Piles

➤ SINCE THE PRIMARY breeding-places of flies are manure-piles, one obvious move in a campaign against flies is to get rid of the manure. Not that it should be destroyed forthwith. Despite its exclusion from polite social circles, manure is mighty valuable stuff—the best of all natural fertilizers.

Best disposal, therefore, is to get it on some land that needs it—farm or garden soil that has not yet been plowed or spaded—and turn it under. Even if it isn't possible to turn it under at once, scattering it over the surface will defeat the flies, for their maggots cannot feed on manure after it has dried. Incidentally, it is definitely not a good idea to use manure, especially fresh manure, as a top-dressing on lawns. Not only will it offend delicate noses, but it usually contains quantities of undigested and still viable weed seeds that will provide your lawn with uninvited plant guests for several years to come. The garden is the right place for manure.

All the garden manuals say that manure should be "well rotted" before use. That means leaving it in the pile until it can be worked on by molds, bacteria and other microorganisms that reduce its organic compounds from their raw state to something more nearly ready for the plants to use. Unfortunately, however, this conflicts with the principle of scattering it and turning it under before the flies have opportunity to use it as a nursery. It is better to lose part of its fertilizer value than to have flies about.

If manure *must* be accumulated, it should be put into a pit or bin with a tight-fitting lid that will exclude most of the flies. Those that breed out in the manure and are looking for a crack to crawl through or a chance to slip out when the lid is momentarily opened can be disposed of by including the bin in the list of places to be treated with residual DDT spray, or by setting up screen-wire fly-traps on top.

If there is no way to avoid having an uncovered manure-pile, fly production can still be prevented by one of several chemical treatments. Simplest and easiest is a solution of borax—a pound or so in ten gallons of water—sprinkled over the surface whenever fresh manure is added to the pile. Sprinkling some of this solution around the stalls will prevent flies from using chance overlooked scraps as breeding-spots.

A better chemical treatment is to sprinkle the manure-pile with a mixture of powdered superphosphate and cyanamid, then sprinkling with water. Besides killing the maggots, this chemical combination heightens the manure's fertilizer value.

Many home gardeners maintain compost-heaps, in which manure, lawn clippings, weeds, garbage and other decomposable wastes are interlayered with soil and slowly ripened into condition for use in the garden. These should give no trouble, for the best-managed compost masses are kept in covered pits or bins as manure should be, and in any case the covering of earth is normally so distributed as to prevent flies from getting at the tidbits they might be interested in.

If flies do hang around the compost-heap, they can be discouraged with the superphosphate-cyanamid treatment. The heap should also be included in the spraying schedule when the attack with DDT begins.

Watch out for heaped-up accumulations of lawn clippings and weeds pulled out of vegetable and flower gardens. These are sometimes tossed aside carelessly, and after being wet down by a rain may begin to ferment. Houseflies do not favor these clumps of rotting vegetation as breeding-places; they prefer something offering more protein for the growth of their larvae. However, biting stable flies breed in such material and if nothing better offers, houseflies will lay their eggs on soggy lawn clippings. So if there is any of this stuff down at the back end of your lot, better see that it is scattered and dried, then raked up and burned. Of course, if you maintain a well-managed compost heap, you will not be wasting the material in this way.

Flies cluster thick around garbage cans left in the open, and will use them as third-choice breeding-places. If the collectors come around as often as they should, that won't matter much; the garbage will be destroyed before the new generation of flies can emerge. However, just for decency's sake the garbage cans and their surroundings should be kept clean. Hose them down when you are washing your car, and don't let spilled scraps lie around. Of course, no garbage can should be without a close-fitting lid.

All these things are personal or family responsibilities of the individual property owner, in city, suburbs or country.

One Weak Link

➤ In an anti-fly campaign it is well to obey the old adage to "sweep before your own door first." But victory will still remain with the flies if the individual householder simply cleans up his own premises and stops there.

Some of the worst of fly-breeding spots are matters of community concern, and if the community doesn't take action on them—well, the flies will still be there.

There is one fly-attracting institution that is more or less on the borderline between individual and community responsibility. This is the old-fashioned open-pit privy, nowadays usually called by the euphemistic name of "outdoor toilet." Under whatever name, it certainly draws flies, which feast there until their fancy suggests adjournment to your sugar-bowl or cream-pitcher. It is not a first-choice breeding-place for houseflies, but it will serve their purpose if no horse stable is handy. Anyway they frequent such places to feed and the danger of disease spread is thus multiplied.

Outdoor toilets are still far more numerous and widespread than the average urban citizen is aware. The U. S. Bureau of Census (which gets data on all mentionable subjects, and some that are unmentionable) reports that more than a third of American dwellings (35.4%, to be precise) are without flush toilets: they either have the outdoor variety, or (in a

small but shocking proportion) nothing at all.

Most of these houses that depend on privies are on farms, where they compete with stable and pigsty for the attention of flies. Of all farmsteads checked by the Census Bureau, only 11.4% had flush toilets. The group classified as "rural, non-farm," which would include many houses commonly thought of as suburban, is a good deal better off; 45% of them have flush toilets. There is solid economic reason for this: sewer extensions into remote suburbs are costly, and so are private septic tanks.

Obviously these necessary but noisome installations cannot be abolished, or even materially reduced in number in one or a few seasons. They can, however, be made less accessible to flies by tight construction and screening. More important still, flies can be prevented from using their contents for breeding-places by liberal use of borax—it should be sprinkled on until the whole surface is white, and frequently renewed.

The really critical problem posed by the outdoor privy, however, is in the strictly urban areas. Census figures show that 9.5% of all city dwellings are without flush toilets. Most of the outdoor installations are to be found in slums and blighted areas—old buildings, not worth the cost of modern plumbing, yet inhabited by human beings compelled often to live at a sub-human level. They are for the most part so poor that they cannot afford to buy borax for sprinkling; often they are so numbed and apathetic that they would not use it if it were supplied free. It is rather a common thing to find one outdoor toilet serving several slum dwellings; since it is nobody's business to keep it clean its condition becomes simply beyond description.

This squalid filth of the slums thus becomes the community's problem. Unless it is cleaned up, and kept constantly cleaned up, a city-wide anti-fly campaign will be a failure in just these worst, most critical spots.

It is right here that fly-fighting forces are sure to meet the toughest going. Little cooperation can be expected from slum dwellers. Worse still, active opposition is likely to be encountered from the landlords. Part of the profit in operating a slum property normally comes out of hanging onto money that would normally be spent on repairs and upkeep. It may therefore be necessary to get the city authorities to apply a little special pressure, to get these reservoirs of potential pestilence emptied, cleaned up, and frequently checked to see that at least elementary decency is observed, and breeding of flies prevented. Here's where community spray apparatus loaded with DDT can do much good.

It is possible, of course, to bypass these plague spots as too difficult to handle. That will mean the acceptance of a certain number of fly-infested islands in an otherwise clean city, and flies may travel miles from their filthy breeding places. It should always be remembered that these open pest-holes in the slums are exactly the spots where germs of typhoid fever, dysentery and other intestinal diseases are most apt to be deposited, and that flies from there may find the rim of your milk-bottle on its way from the dairy

to your door. By-passing a too-tough slum in a fly-eradication campaign is like by-passing an enemy strong-point in cleaning up a combat area. Ask any man with an overseas ribbon what that is likely to mean.

Fighting Beelzebub

➤ FLIES have had a long and thoroughly dishonorable history. Everybody has heard of "Beelzebub, prince of devils." Well, the original Babylonian form of that name was Ba'al-z'bub, which means the god of buzzing things, that is to say, god of flies. Ancient Orientals had little idea of sanitation, and certainly few of them practised even its rudiments; nevertheless, somebody seems to have instinctively hit upon the right idea when he invented that particular foul deity.

The ancient Egyptians apparently did not deify the fly, though they did special religious honors to that other offspring of the dungheap, the scarab. However, their sculptures and tomb paintings carry graphic testimony to the abundance of flies even in the palaces of the Pharaohs. Did you ever notice, in Egyptian pictures, those long-handled fans of peacock feathers borne by the royal flunkeys? Their main function was to keep the flies from settling on the royal person—or drowning in the royal beer-goblet.

There is no particular point in reviewing the history of flies through the ages because until practically the beginning of the present century all the ages were Dark Ages. People considered flies nuisances when they were thick, and tried to brush them away. When they were fewer, they were interesting objects for nature study.

Quite typical is the nineteenth-century nursery jingle that begins:

"Baby bye, here's a fly,
Let us watch him, you and I."

Imagine a twentieth-century mother even tolerating a fly in the same room with her baby, let alone inviting the infant's attention to it as something pleasant and interesting! And a little further along, the couplet:

"I believe with six such legs
You and I could walk on eggs!"

is an index to the relative indifference people then felt to having flies tracking around on their food. To be sure, the many covered dishes of those days were intended to keep flies out: it was a bit embarrassing to have them getting drowned in the gravy or bogged down in the butter. But so long as nobody knew about germs, nobody got very squirmy about it.

When a fly got into difficulties, it might even attract sympathy, as a harmless and helpless little creature. Shakespeare has forlorn old King Lear say,

"We are to the gods
As flies to wanton boys:
They kill us for their sport."

And in the later and less literate effusions of "The Spider and the Fly" type, the spider was always the villain and the poor fly always the victim.

That is not the way people regard really dangerous animals. Nowhere in literature are serpents and scorpions treated as harmless interesting creatures, to be pitied if they come to a bad

end. But it was centuries before people discovered that the hidden sting of a fly, though disguised and delayed, can be deadlier than the bite of an asp.

Realization of the potential deadliness of flies came to the American people suddenly and dramatically. During the Spanish-American war of 1898, raw recruits herded into camps in the South suffered ghastly losses from disease, especially typhoid fever. Newspaper reports said they "died like flies." It would have been more accurate to say that they died of flies. Flies swarmed over their food in the unscreened mess tents, and it could easily be told from their white feet that they had come directly from nearby open-pit latrines into which lime had been sprinkled in a feeble attempt at sanitation.

By that time, the germ theory of diseases launched by the brilliant researches of Pasteur had had about 20 years of impact on medical thinking and practice. The significance of that deadly circuit from latrine to mess tent was not lost on the Army physicians. The venerable entomologist, Dr. L. O. Howard, proposed renaming the insect "typhoid fly" instead of housefly. The phrase "Swat the fly!" was born.

Diseases that have been proved to be fly-borne are mainly those of the digestive tract: typhoid fever, amebic and bacillary dysentery and diarrhea. The latter two probably comprise most cases of what used to be called "summer complaint" in babies. Flies have also been accused of carrying a number of other diseases, but the proofs are not so strong. At present, flies are under suspicion of being the bearers of poliomyelitis or infantile paralysis, but here again they have not been conclusively proved guilty. No matter: their absolutely known offenses are bad enough to merit the death sentence.

The first "swat-the-fly" campaign, shortly after the turn of the century, was not very successful for a number of reasons. For one thing, there were still many horses even in the cities; and where horses are, flies will breed. For another, effective fly-killing means were lacking: fly swatters and sticky fly-paper are not very effective weapons. Moreover, a bad mistake was made in offering cash bounties for quantities of dead flies brought in: some ingenious and unscrupulous individuals actually bred flies for this "market."

Still, some good was accomplished. The fly lost its position as a tolerated nuisance, houses and stores were more generally screened, and the increasing use of automobiles and plumbing in cities deprived flies of many natural breeding places.

Most important factor, probably, was the attitude of people toward flies: they became recognized as the vermin they are, and were no more welcome on the premises than rats or bedbugs. People hated them, killed them individually when they could, and were restrained from a war of extermination only because of the lack of suitable weapons.

Now the weapons are available: clean-up campaigns plus intelligently applied DDT spraying. These were tried out in a number of communities last year; the summer of 1947 can be remembered as the year of the Great Fly Massacre if everybody makes up his mind to participate.

On the Back Cover

Here's a phase of fly life seldom seen except by entomologists: a collection of pupae, or flies in the resting stage between maggots and full-fledged insects. To show scale, a pocket-pencil point is included.

Synthesis of Pyrethrin Foreseen

Synthesis of pyrethrin, an insecticide produced from Asiatic and East Indian flowering plants, may be possible in the near future, says Dr. William M. Hoskins, professor of entomology in the University of California College of Agriculture.

Laboratory production of pyrethrin would have important consequences, Dr. Hoskins says. He points out that pyrethrins now cost over $25 per pound, and are still able to compete with other insecticides.

If synthetic pyrethrin can be made for half that price, it may even be possible through synthesis to create a pyrethrin that will be active for a much longer period.

While synthetic pyrethrin is not yet ready for use in agriculture, pyrethrin sprays, the potency of which has been increased by the addition of the chief alkaloid of black pepper, piperine, are now being used.

Pyrethrin is obtained from the powdered flowers of the Pyrethrum genus of plants of the East. The roots of these plants produce a drug used in neuralgia, toothache and headache.

HET Gets Bugs DDT Misses

Meet HET, newest terror to bugs. U. S. Department of Agriculture entomologists state that it seems well suited for combating red spider and red mites, two plant-damaging pests that survive DDT attacks and increase enormously when DDT wipes out competing insects. Combination of the two looks good for clean-up purposes. University of Wisconsin tests show that HET is also effective against aphids on cabbage and potato crops.

HET, which is hexaethyl tetraphosphate when spelled out, is a German chemical invention, which does not have the persistent, long-lasting protective effect that DDT gives. Further tests are planned for the coming crop season, but it will not be available for general use this year.

Braxilian diamonds, mostly industrial, were sent to Europe for cutting prior to the war; now Brazil has some 4,000 trained cutters able to produce work of satisfactory standards; they were taught in Brazil by Belgian and Dutch craftsmen.

New Sub-Atomic Particles
Cause Cosmic Ray Showers

Neutral Mesons

➤ THE SCIENTIST who put together the atom bomb has explained the way in which the most powerful projectile man knows—cosmic rays—do their stuff.

An unappreciated sub-atomic particle, the neutral meson, plays a major role in the latest cosmic ray theory of Dr. J. Robert Oppenheimer of the University of California, former director of Los Alamos atomic bomb laboratory.

Neutral mesons live but a mere one ten-quadrillionth of a second after they are created by mysterious primary proton bombardment from outer space. Even so, they are responsible for the astounding showers and cascades of powerful radiation that continuously rain upon the earth, even penetrating your body as you read this.

Mesons, which may be positive, negative or neutral in electrical charge, sort of lurk in the nuclei or hearts of nitrogen atoms in the rare air in the upper reaches of the atmosphere. Along comes a one billion volt particle, a proton, from somewhere in the cosmic depths of the universe. It smacks the nitrogen atom's heart. Mesons by the many thousands fly out. Each neutral meson disintegrates into a pair of gamma rays, powerful X-radiation, that literally bombard the atmosphere below creating all sorts of effects there.

"I am glad this has nothing to do with atomic energy," said Dr. Oppenheimer. This is not a theoretical prelude to a new kind of atomic bomb, so far as can be seen now.

It may be more important than atomic energy. For it may explain the fundamental character of matter and energy. Science may be now making its "last great push" in exploring the realm of theoretical physics, mother science of the atomic bomb.

There is evidence, Dr. Oppenheimer told the American Physical Society, that the same laws that govern the ten billion volt particles rule the ten quadrillion volt particles of the even more powerful cosmic radiation. There was apprehension that new particles and new laws would be needed to explain what happens in these higher energy realms.

So far the most powerful particles accelerated by human control are the two hundred million volt deuterons (hearts of heavy hydrogen atoms) in the new big Berkeley cyclotron.

More powerful atomic particle accelerators are building now. In a few years man will match the cosmic rays and produce mesons at will. Scientists are using rockets to get nature's cosmic rays recorded 20 to 100 miles above the earth. Science is in the midst of one of the greatest explorations of all time.

Make an Array of Subjects and Learn as You Search the Literature

Key to Chemical Knowledge

by C. L. BERNIER and E. J. CRANE

The Editors of "Chemical Abstracts" tell how to use that great index to stored chemical information, to the researcher's best advantage, in this paper given before the American Chemical Society's section on Chemical Literature at the Atlantic City meeting.

➤ THE PERMANENT value of a set of abstracts depends largely on adequate indexes. Abstracts are not made up of definite, uniform, single units of information so that classification of them in a published journal does not prevent information from becoming buried. The common alphabetically arranged subject index has been the most effective key thus far to such information.

The great bulk of rapidly accumulating chemical information has led to the need for big annual and huge collective indexes, which present some challenging problems in nomenclature, form, structure, and the effort for consistency, accuracy, and adequacy. Furthermore, modern mechanical devices such as machines operated by punched cards and still more recent developments with electronic devices have raised questions as to possible substitutes for indexes. Without denial of the possibility of mechanized assistance in dealing with chemical literature, which possibilities are being thoroughly investigated, it seems fitting at this time to provide some information on the building and use of subject indexes. For general use these are not likely to be supplanted.

Chemical Abstracts publishes five different kinds of indexes. These are based on (1) author names, (2) subjects, (3) empirical formulas of compounds, (4) patent numbers, and (5) organic ring structures.

What is an index? A good index is something more than a key and a pointer. It is a sort of inanimate memory. The human memory and indexes seem quite similar in that both store information in such a way that it can be recovered upon demand. Indexes bring together like information and, with their cross references, help in the correlation of data. The whole picture of what is happening in the field covered by an abstract journal can be gained in outline form from its indexes. An index can become a source of good nomenclature information.

What is a subject? It is that concerning which anything is said or done. It is *not* a word or a phrase. Too often so-called subject indexes are really just indexes of words. Words are but the tool of the indexer. They must be used in such a way as to avoid scattering of references to like subjects, omissions, and unnecessary entries. A subject suitable for storage in a subject index can be anything known to man. For this reason, sub-

ject indexes are the most flexible and comprehensive of all kinds.

Like a Relief Map

We like, at times, to think of an abstract as resembling a relief map modeled in clay. The peaks on the map correspond to the novel or emphasized information of the abstract which, in turn, reflects the novel or emphasized information in the original paper. It is not difficult to pick out the high peaks on either the map or the abstract. One has difficulty occasionally with the very minor peaks —in knowing whether to select them or not. Most of these problems are solved by an attitude of generosity; "When in doubt, index" is the motto. It is borne in mind, however, that an index can be harmed (cluttered up) by too many entries just as it can be harmed by too few entries. The time of users is regarded as too valuable to ask them to follow unfruitful leads.

Once the indexable information is selected, the next task is to fit it effectively into the pattern of the index. Thus, if the heading *Density* had been used before in the index, it would be unwise to start the heading *Specific gravity*. Headings preferably consist of words most commonly used by chemists instead of synonyms or related words. In this way, information is put where the majority of index users will look first.

Some index headings, such as density and viscosity, are considered general headings, suitable for entries on methods of measurement, relationships, and the like, but not for studies where specific values of density or viscosity are given. Thus, a study on the values for the density of mercury at various temperatures would be indexed under *Mercury* but not under *Density;* whereas a study on methods for the determination of the density of mercury would be indexed under *Mercury* and under *Density,* the latter entry being made because of possible application of the methods of measurement to other substances. This is another phase of fitting selected information into the pattern of the index.

The different headings have definite and, occasionally, highly restricted meanings to the indexer. The sense in which the heading is used can be discovered by a glance at the entries under it. Thus, "Ceramic materials" means, in an index to *Chemical Abstracts,* the clay and other raw materials, whereas "Ceramic ware" means the finished or partly finished ceramic products. "Refractory materials" means materials refractory to heat and not necessarily to corrosion. "Waterproof materials" means materials resistant to swelling, discoloration, destruction, and shrinking by water, as well as those merely resisting penetration by water. This process of fitting the selected information into the pattern of the index often takes more time than selecting the information. This is especially true for the indexing of complicated chemical compounds. This fitting of the information into place is, in a sense, a process of classification; however, the index so produced is not a classified index in the sense of systematic classification. Thus, 2-butene is considered best entered under its own name rather than under *Olefins* which, in

turn, might be placed under *Hydrocarbons.*

The consistent fitting of information into the index requires extensive knowledge of the index. This requirement makes the training of indexers a long process. The indexers for *Chemical Abstracts* have hundreds of guiding notes to help in this. If a new bit of information does not fit under one of the existing headings, then a new heading is started. Once a heading is started, it is rarely abandoned unless shown to be unsuitable or incorrect.

Theory and the Index User

It is obvious that the views held by the indexer on the subject of building indexes will largely control the method of use of the index. If the indexer selects only novel or emphasized information, then the user will not be able to locate trivial information. Should he be able to? By trivial information we have in mind such information as would answer questions like these: "In what papers published this year are 250-cc. beakers, or potassium permanganate, or oxidation reactions, or molecular distillation mentioned?"

The searcher will be able to find only those papers in which these subjects were really studied with the provision of new information. Incidental mention, the words, will not be found indexed. It is also true that if the indexer selects only *titles,* then the user may miss information located in the body of the article or abstract. If the indexer selects only important *words* (word indexing), then the user may miss *subjects.* The user, in short, is limited by the theories of the indexer.

With an alphabetical index, the user constructs, in a sense, his own classification scheme by selecting an *array of headings* under which he wants to look. Thus, each index user can tailor-make his own classification scheme. This array of headings may consist of synonyms, more-general headings, more-specific headings, and otherwise related headings, such as those representing reciprocal topics. For example: A chemist interested in *something* about *hexoses* would construct an array concerning the "something" and concerning hexoses. For the second part of the array, he would probably find the most pertinent information at the heading *Hexoses.*

If he desired to extend his search, he would do well to include in his array of search places headings representing specific hexoses, as *Glucose, Fructose, Galactose, Allose,* etc. His array might profitably include more-general headings, as *Sugars, Carbohydrates, Oses, Glucides,* etc. There is the possibility that he might gain useful information from related headings, as *Pentoses, Glycosides, Arabinose,* etc. The index user constructs his array with the help of dictionaries and other reference works; as he starts his search he is helped by cross references, which really constitute a rudimentary sort of array. In this connection there should be mentioned the interesting possibility of preformed arrays. These could be printed in a book which would resemble a thesaurus, or put onto punched cards. A preformed array might be compared to a ready-made suit of clothes. It is possible that the array suit could be made to fit fairly well most of the problems a chemist meets. The chemist could then play tailor and alter the array exactly to suit his needs

more cheaply and more rapidly than by starting from scratch with yard goods, that is, reference works.

These arrays that the user of an alphabetical index may need to construct are not, or should not be, static things. They should grow with the searches. It is difficult to conceive of how a novice could construct anything even faintly resembling a complete array. And everyone who starts into a new problem must be something of a novice. The growth of an array need not occur all at one sitting; as the laboratory research progresses, the array should expand. This is an argument for making one's own literature searches.

From the preceding, it becomes easier to define the limit of usefulness of an alphabetical index. The limit of usefulness of an alphabetical index for a given problem is largely determined by the difficulty in forming a suitable array of search places. Difficulties connected with arrays are brought about by the size of the array, the searcher's lack of knowledge and ingenuity, his lack of availability of suitable reference works, and the frequency of change of arrays. Thus, an author writing a monograph on brominated hydrocarbons would find the Subject Indexes to *Chemical Abstracts* not very useful because the array of search places would be so large. Putting it another way, the Subject Indexes to *Chemical Abstracts* were not designed for generic searches of this nature. This kind of search is regarded as too special to justify the expense of the much expanded indexes which would be required and, still more important, to justify the probable awkwardness introduced into the index for the usual needs.

Suggestions for Index Use

In connection with index searching, there is at least one field in which our knowledge is elementary; that is the psychology of the process. Various research directors have reported difficulty in getting their men to consult the literature. This difficulty may be caused by various factors. Index searching is a passive sort of thing compared to laboratory work; it is not so satisfying to the creative urge. Also, all of us feel, I am sure, a certain sense of bewilderment when we enter a library with a need to answer a specific question. Fortunately this feeling is usually short-lived and is often easily dispelled by starting to search almost anywhere, even in the less-likely places. It may be replaced by a feeling of delight in information and ideas discovered. As the search proceeds, there may develop a feeling of uncertainty as to its completeness. Information may never have been discovered, it may have been discovered but not published, or abstracted, or indexed, it may have been indexed in the wrong place, or the searcher may be looking in the wrong places. There is also often the uncertainty as to how much effort one is justified in investing in a search. Furthermore, is it not true that research chemists sometimes search diligently in the literature for information that they hope they will not find? If they do find the information they seek, then their research problem has evaporated.

The best place to look first in an index is the word coming first to mind. It is not wise to try to "outwit"

the indexer, so to speak. His first concern is putting the information where the user will look first. If the first word fails to disclose the information, then an array of search places can be made. The array is probably best started with synonyms, for example, vitamin B_1, thiamin(e), aneurin(e), etc. When the index is searched for synonyms, "See" cross references may be found. These will lead to the headings of main interest. The remaining synonyms should be checked to eliminate the possibility of losses from scattering. This is especially true for "synonyms" which are trade names.

After the main headings have been located, the array can be expanded to include more-general headings, more-specific headings, and otherwise related headings. Confidence in the completeness of the array can often be increased by noting the increasing frequency with which the same paper is picked up through different parts of the array. The array should expand with the literature search and also with the laboratory work. This index-searching process is a developing, unfolding sort of thing; it is really an educational process — the more one knows, the more varied is the information that becomes acceptable and useful. It is highly improbable that all of the useful information will spring from the index at the first glance.

Once a desired heading has been located, the best method of searching among the modifications becomes the next concern. Many times a glance will reveal the desired information or its absence. Under the larger headings, it will take something more than a glance. Since experience has shown it difficult to predict the word starting a modification, it may be necessary to read every modification. This is not such a loss of time as it might at first seem, since it offers a good opportunity of discovery of substitute, related, and accidental information. The modifications can be arranged then into an order of probable importance to the index user, or a number of modifications can be selected and arranged likewise. The list can be looked up, starting with the most important, and the process continued until too little relevant information is discovered to justify continuance.

After the main entries have been looked up, read, and digested, it is sometimes well again to read the modifications under the more important headings, since the increased background of knowledge on the subject will make more information understandable and acceptable to the searcher. Now that a start into the literature has been made, the references found printed in most scientific papers will probably provide much further information. Author indexes are often of help, at this point, in locating more information, since authors tend to specialize in their research. In some respects, searching the literature may resemble a nuclear chain reaction; it may be difficult to start, but once started, it may be difficult to control since the reference multiplication factor is usually much greater than one.

It is desirable to read the entries under a heading slowly because it takes time to add, from the imagination, the supplementary information that the indexer had to leave out of the index. One might think of an index

user as a paleontologist. The entries he discovers are the bones of yesterday's information. As he looks at these entry bones, he must judge, from their size, shape, quality, and location, to what kind of subject animal they belonged. The paleontologist reconstructs the whole animal from the fragment of bone he holds in his hand; the index user reconstructs the source information, with similar imagination, from the entry he holds in his mind.

No More Uranium Pottery

➤ SOME OF THE fissionable ingredients of atomic bombs which you have around the house may become rarities but your light bulbs will shine just as brightly.

These are some of the facts of life in an atomic age. Yellowish-green, fluorescent glass, getting its unique qualities from uranium, cannot be manufactured in the United States after April 1, under regulations laid down by the U. S. Atomic Energy Commission.

Pottery plates, cups and vases with a certain striking red color and a sort of yellowish tinge are out, too. The color came from uranium, and some of these pieces, which were very common before the war, may become collector's items.

Light bulbs, however, will continue to use thorium, which scientists have found can be used with uranium in an atomic bomb. The well-known tungsten filament of light bulbs contains one to one and one-half percent thorium to increase the light.

Rules issued by the Atomic Energy Commission prohibit use of uranium in ceramic or glass products and in photographic work, unless under "exceptional circumstances," after April 1. Ceramic and glass products with uranium are already scarce because the use of uranium was curtailed during the war.

In photography, uranium is used in toning baths, but other satisfactory chemicals are available and more frequently used. Uranium compounds for photographic use have not been sold for several years due to wartime restrictions.

Under the commission's regulations, which became effective April 1, licenses will be required for all materials with one-twentieth of one percent of uranium and thorium or any combination of the two elements.

Glass, ceramics and photography are listed as exceptions to this rule, but another provision says there will be no further supply for use in those products.

Incandescent mantles, refractories, certain rare-earth metals and compounds, and vacuum tubes are exempt from licenses as is any transfer or delivery during one calendar month of uranium or thorium ores which contain less than 10 pounds of the metals.

In addition to light bulbs and many specialized tubes which use thorium, crucibles using thorium oxide, employed in melting such elements as platinum, and compounds of rare-earth elements which naturally contain some uranium or thorium will be permitted without any license.

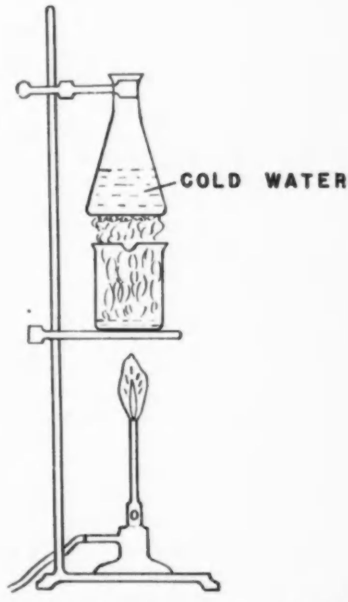
For the Home Lab

The Hot-Headed Halogens—III

Iodine

By Burton L. Hawk

▶ Iodine, the most beautiful and most gentle member of the halogen family, first saw the light of day in 1811 when it was isolated by Bernard Courtois from the mother liquor obtained from algae. Upon adding an excess of sulfuric acid to a concentrated portion of the liquor which he prepared by extracting the ashes of marine plants with water, Courtois was no doubt greatly surprised to see lovely clouds of deep violet vapor arising from the liquid. He found that this vapor would condense to form dark lustrous crystals, and that these crytals would combine directly with certain metals, with phosphorus and with hydrogen. Later investigation by Gay-Lussac proved the substance to be a new element and it was christened *iodine,* from the Greek word meaning "like a violet."



To prepare iodine, mix together 2 grams potassium iodide and 3 grams manganese dioxide. Tranfer the mixture to a small beaker and add 10 cc. of dilute sulfuric acid. Gentle heat will produce clouds of violet iodine vapor. Place a flask of cold water over the beaker, or cover the beaker partially with an evaporating dish. Crystals of iodine will form on the bottom of the flask or dish. The iodine passes from the gaseous state directly to the solid state. This process is known as *sublimation*. Scrape crystals off and dry them on blotting or filter paper.

To the average person iodine is known only in the form of the tincture, used as an antiseptic, which is a solution of iodine in alcohol. The medicine-cabinet variety usually contains 2% iodine. Although some people prefer the bright red of Mercurochrome to the brown of iodine, the latter's efficiency as an antiseptic cannot be denied.

Iodine will also dissolve in carbon tetrachloride or disulfide, forming a violet solution.

Another antiseptic compound of iodine is *iodoform,* CHI_3, a yellow powder with a characteristic "antiseptic" odor. Dissolve iodine crystals in potassium iodide solution until the liquid is dark brown in color. Add 5 cc. of this solution to an equal amount of alcohol. Now add sodium hydroxide solution in small proportions until the brown color disappears. Upon heating a few minutes and then cooling, a yellow precipitate of iodoform will separate out.

Another and perhaps better method of preparing iodoform is by dissolving 1 gram of potassium iodide in 20 cc. of water and adding 1 cc. of acetone. To this mixture add a dilute solution of sodium hypochlorite (You can use "Chlorox" from the grocery store). The yellow precipitate of iodoform is immediately formed.

The direct combination of iodine and phosphorous forms an exciting demonstration as these two elements celebrate their union with a spontaneous display of fire. In a large evaporating dish, carefully place a *very small* piece of white phosphorous. Drop on the phosphorous a few small crystals of iodine. Keep your face a safe distance away. The mixture will suddenly burst into a brilliant flame, evolving large clouds of smoke. The result of this elaborate performance is a red compound, phosphorous triiodide, PI_3.

With red phosphorous, the action is much milder. If water be added to the mixture of red phosphorous and iodine, hydrogen iodide is formed:

$$2P + 3I_2 \rightarrow 2PI_3.$$

$$PI_3 + 3H_2O \rightarrow 3HI + H_3PO_3.$$

Speaking of hydrogen iodide, one would suppose it could be formed by the addition of sulfuric acid to an iodide (similar to hydrogen chloride). But such is not the case. Add a little sulfuric acid to a few crystals of potassium iodide in a dry test tube. You will notice the violet vapor of iodine and if you smell at the mouth of the tube you will no doubt recognize the delightful aroma of hydrogen sulfide. Now how did hydrogen sulfide get into the picture? Well, it appears that iodide was temporarily formed, but being much less stable than hydrogen chloride, is therefore a more active reducing agent. And the nearest thing around for it to reduce is the sulfuric acid, and it promptly reduces same to hydrogen sulfide:

$$H_2SO_4 + 8HI \rightarrow H_2S + 4H_2O + 4I_2$$

If you add a solution of sodium thiosulfate to a solution of iodine in potassium iodide, the brown color will entirely disappear. Hence this thiosulfate is an effective agent for removing iodine stains. You may use it to remove any brown stains you have acquired on your hands. Of course, if you have been a careful worker, there will be no stains to remove. . . . .

The ordinary tin can in which food is preserved is less than 2% tin and over 98% steel; steel gives the strength, and tin the weather-stripping and insulation that provides extra protection to the can's contents.

Chemical Processes and
Processes Using Chemicals

Recent Patents in Chemical Fields

Copies of complete patent specifications may be ordered by patent number for 25 cents each. Send currency or money order, but not stamps. Address Commissioner of Patents, Washington 25, D. C.

Iron-Smelting by Heated Oil

➤ IRON IS extracted from ores of high oxygen content, like limonite and magnetite, by a process using oil heated to the cracking-point as part of its fuel, on which U. S. patent 2,417,949 has been granted to Elfego Riveroll of Hermosa Beach, Calif.

Reduction of the ore is carried out in three steps. First the ground-up ore is fed through a chamber where it meets high-temperature flame that drives out all water present and loosens up its texture. Then it passes to a second chamber where it is mixed with oil heated to the cracking-point; the released carbon and hydrogen atoms seize upon part of the ore's oxygen, thus beginning the reduction process. Finally, in a third chamber that is really an electric furnace from which all oxygen has been excluded, it is further heated in the presence of coke or other form of solid carbon, which completes the reduction.

X-Ray Electron Microscope

➤ THE PRINCIPLE of the electron microscope is applied in the production of X-rays for the purposes of spectrographic analysis in a setup designed by one of the leading workers in the field, Dr. James Hillier of the Radio Corporation of America, to which firm he has assigned his patent, No. 2,418,029. A beam of electrons is focussed in the customary way on the object to be analyzed. Striking it, the electrons cause the emission of X-rays. A beam of these, screened through a pair of slits, strikes a crystal, which scatters them in characteristic diffraction pattern and permits a photographic record to be made.

Rugosimeter

➤ A NEW LABORATORY instrument called a rugosimeter, for measuring the roughness of surfaces, is offered by Dr. Melvin Mooney of the United States Rubber Company for patent 2,417,988. Air under pressure is blown through an opening in the middle of a smooth plate applied to the surface to be measured. The rougher it is, the more openings for air flow it will offer; hence a pressure gauge can be used to give an integrated reading of the surface's roughness.

Meat Preservative

➤ A REFINEMENT of the time-honored method of preserving meat by pickling it in vinegar is the basis of patent 2,417,806, issued to Hans F. Bauer and Elmer F. Glabe of Chicago, assignors to Stein, Hall and Company, Inc. They use an acetic acid salt, preferably sodium diacetate.

Protective Container

➤ ANOTHER REFINEMENT of the vinegar-pickling method is the subject of

patent 2,417,889, granted to M. J. Stammelman of New York. He makes a food container with porous walls, which he impregnates with vinegar. The acetic acid vapor, slowly given off, prevents the development of spoilage molds and bacteria.

Phosphate from Waste

➤ Food production calls for fertilizer, and among fertilizers phosphate is one of the most important. Unusual interest therefore attaches to a newly patented process in which sulfuric acid sludge, a waste product in oil refining, is used instead of new sulfuric acid in treating ground phosphate rock to produce superphosphate fertilizer.

In the method now in use, a mixture of phosphate rock and sulfuric acid is left for a time in "dens", while the gases caused by the acid's action froth up and lighten the product. Even so, it takes stiff digging, sometimes blasting, to get it out for sacking and shipping.

By using the sulfuric acid sludge, claims John Stauffer, Jr., of Los Angeles, originator of the process, the mixture in the dens foams up more thoroughly, due partly to the evaporation of the residual hydrocarbons in the sludge, and when the finished fertilizer has dried out it is already in powder form, ready to flow down chutes into the bags.

U. S. patent 2,418,203 has been issued on this process.

Rafters Save Tank Tops

➤ Gasoline and other volatile liquids stored in steel tanks undergo some evaporation each day and recondensation at night. This flexes their tops up and down, often causing leaks by opening seams or breaking the metal. To minimize this damage, James O. Jackson of Crafton, Pa., has designed a tank having ring-shaped rafters on which the top can settle when it is in the "down" position, thereby saving the major part of the strain. Patent 2,418,229, issued on this invention, has been assigned to the Pittsburgh-Des Moines Company.

Non-Glare Mirror

➤ A non-glare rear-view mirror, that will not annoy following drivers at night with dazzling reflections, is the invention on which W. H. Colbert of Brackenridge, Pa., and W. L. Morgan of Columbus, Ohio, have been granted patent 2,418,335, which they have assigned to the Libbey-Owens-Ford Glass Company. High reflecting power in rear-view mirrors is unnecessary; the inventors reduce the reflectivity of theirs by chemically spattering it with minute spots of lead sulfide.

SO_2 Recovery

➤ Sulfur dioxide, used in pulp paper manufacture but wasted in considerable quantities in the process, is captured by condensing the steam that accompanies it in its escape, thereby automatically preparing a water solution of it for re-use. This new process is protected by patent 2,418,167 issued to H. A. Du Bois of Neenah, Wis.

Food-Processing Inventions

➤ Two improvements in food processing, one for quick-freezing, the other for dehydration, are among the newly patented inventions. The first, designed by L. H. Bartlett, W. R. Woolrich and H. E. Brown, all of Austin, Texas, utilizes the principle of the archimedean screw to move food products

rapidly through such viscous freezing media as syrup. Rights on the patent, No. 2,418,746, are assigned to the Texas Research Corporation.

The other machine tumbles vegetables back and forth across beds of rollers placed one above the other, while a blower sends a blast of air through a heating coil, then around the vegetables. This invention is covered by patent 2,418,683, granted to Broadus Wilson of Raleigh, N. C.

Infra-Red Filter

➤ Two Massachusetts inventors, R. G. Shepherd, Jr., of Needham Heights and C. D. West of Cambridge, present a filter that is opaque to visible light but transparent to infra-red rays, for patent 2,418,605, which they assign to the Polaroid Corporation. The filtering properties are embodied in a sheet of dyed regenerated cellulose, which is protected against mechanical injury by placing it as the sandwich layer between two panes of glass.

Insecticide Series

➤ A du Pont chemist, Euclid W. Bousquet, has assigned to his employing firm patent 2,418,458, on a new series of insecticides. Typical composition is represented by a hydroxy compound of pentamethylflavan with acetone and a phenol.

Air-Conditioning for Beef

➤ Newest air-conditioned industrial process is one applied to the conventional "ripening" of beef by letting the sides hang in a room of moderate temperature for a few days after killing. It is the invention of Paul B. Christensen of Fair Lawn, N. J., to whom U. S. patent 2,419,119 has been granted. Rights in the patent are assigned to the Westinghouse Electric Corporation.

Immediately after slaughtering and dressing, beef is chilled, then placed in the warm humid tenderizing room. This causes water condensation on the meat, often producing discolored streaks and spots and encouraging growth of fungi and bacteria.

In the new process, the temperature of the room is raised sharply for a short period after the fresh meat has been introduced, and at the same time the air is circulated vigorously. This evaporates any water that has condensed on the meat. The temperature is then gradually reduced to the proper tenderizing level.

New Gasoline Synthesis

➤ An improved way to produce synthetic gasoline out of the carbon monoxide and hydrogen of water-gas is covered by patent 2,418,899, issued to three New York inventors, E. F. Pevere, G. B. Hatch and E. E. Sensel, and assigned to The Texas Company. The improvement consists primarily in the addition of isobutane or other branched-chain hydrocarbon to the gas mixture. The product, the inventors state, has anti-knock properties superior to those of previous synthetic motor fuels.

Chlorinated Hydrocarbons

➤ Objectionable bacteria and algae in water supplies can be killed with chlorinated lower hydrocarbons, for example trichlorobutane, trichlorohexane, etc., instead of straight chlorine, which is itself often objectionable, states Charles W. Harnden of Berkeley, Calif. Patent 2,419,021, which he has obtained on this discovery, is as-

signed to the Shell Development Company.

For Soil Fumigants

➤ EXPLODED MICA, coarse sawdust and other granular, porous substances are used as carriers for soil fumigants like the chlorides of ethylene, propylene, etc., which have been found effective for the control of borers and other soil-dwelling pests. This invention, protected by patent 2,419,073, is the work of O. H. Hammer of South Haven, Mich., assignor to the Dow Chemical Company.

Rubbery Synthetic

➤ A SYNTHETIC rubberlike insulating compound invented by a German, Willi Mertens of Berlin, is the subject of patent 2,418,978, vested in the Attorney General. It is a mixture of polyisobutylene, styrene and paradivinylbenzol, heated until it has become soft and rubbery.

Smoke Eliminator Saves Coal

➤ A SMOKE ELIMINATOR suitable for ships at sea turns out to be an efficient coal-saver as well, recent tests made by British government officials prove.

The eliminator, which can be used with present boilers on most ocean-going vessels, is described as a simple and inexpensive device that is found to save up to 5% of the coal. It can be used on land as well as marine boilers, and can be used in industrial towns to rid them of smoke nuisances.

Work in developing the smoke eliminator was begun early in the war so that ships at sea could proceed without black belches visible to enemy eyes. The coal-saving tests, just completed, were made on a 7,000-ton cargo vessel on an outward and return run from England to Freetown, West Africa. Representatives of the British Department of Scientific and Industrial Research accompanied the ship and their report has just been issued in London.

On the outward trip, the vessel's starboard boiler was equipped with the device and the port boiler left as it was. On the return voyage, the equipment was switched from starboard to port boiler. Coal used was carefully weighed, and throughout the journey a smoke indicator was used to detect any smoke escaping.

The principle used in the smoke eliminator involves the admission of air into the combustion chamber over the coal where it mixes with the gases and vapors formed from the coal by the heat of combustion. This air causes these gases and also the tarry vapors that form over the coal bed to burn completely. When the smoke detector indicates that no more volatile substances are being formed from the freshly applied coal, a valve is closed that cuts off the air in-take.

The saving in fuel comes from the combustion of the volatile vapors and gases. When coal is placed on a hot fire the volatile matter, about one-third of many coals, is distilled off. When smoke is made, these tarry vapors are "cracked" in the furnace to form soot and invisible combustible gases that ordinarily escape up the smokestack. If the vapors are burned in the fire box before cracking takes place, then smoke is prevented and the heat of their burning is added to the usable heat of the boiler.

Hints for Your Lab

Caution With Organic Chemicals!

This department is for exchange of ideas and discussion of methods and techniques among readers who are lab enthusiasts.

➤ IN THE MARCH, 1947, issue of CHEMISTRY there appears a hint for cleaning glassware by Alan F. Roberts.

Mr. Roberts suggests the use of a strongly alkaline solution of potassium permanganate rather than acid dichromate. I question if this is really wise. I do not know the true oxidizing power of permanganate in strong alkali but I do know that it is a powerful oxidizing agent in strong acid and suspect that this is true also in strong alkali. If this is the case, then it is very dangerous to use the permanganate solution for cleaning glassware which is used with organic reagents. A number of instances are known to me, and some of my former colleagues at the University of California, where explosions or fires have arisen due to this technique prior to its prohibition by the department there.

Acid dichromate is a less powerful oxidizing agent, and even it should be used with caution. That is, wash out the glassware first with an organic solvent, then water, to remove, if possible, all but the tarry residue. Treatment with aqueous trisodium phosphate, water, and then cleaning solution is found to be quite successful.

LLOYD N. FERGUSON
Assist. Prof. of Chem.
Howard University,
Washington, D. C.

The Editors of CHEMISTRY *strongly second Prof. Ferguson's warning about the dangers of using strong oxidizing agents on organic chemicals. In addition they deplore getting glassware into such a state that drastic cleaning measures are needed. Wash up your apparatus as you go along, with the proper solvents, is the best laboratory rule.*

➤ PROF. FERGUSON, by-the-way, is the author of an amusing play, of the broad comedy variety, which uses a lot of chemical tricks and stage effects to good advantage. A number of years ago CHEMISTRY, then the *Chemistry Leaflet,* used to publish chemical plays and ideas for chemical demonstrations. We wonder whether today's readers are interested in chemical shows? Would you like suggestions along this line occasionally in the magazine? Or don't you mix frivolity with your science?

Address your reactions to Hints Editor, Chemistry, 1719 N St. N. W., Washington 6, D. C.

Contributions to "Hints" should be typewritten on one side of the paper. Drawings of apparatus should be in India Ink, or in pencil lines without shading. Descriptions of equipment which you have built and found convenient in your laboratory, and directions for experiments and preparations which you have enjoyed making are acceptable for this department. Two dollars will be paid for each Hint published.

Scientists Make Progress In
Understanding Radiation Damage

Protection Against A-Bomb Effects

Prime concern of many scientists today is how to protect against the new dangers brought by the chemicals and the radiations associated with fission and release of nuclear energy.

➤ ADD TO THE DANGERS of the atomic age, a new disease that causes greying hair, liver damage and bone cancer.

It is called "plutonism" and the atomic bomb element, plutonium, which is poisonous, would be responsible.

Workers in industries using atomic piles for power generation or other purposes will have to be protected against this new disease, just as workers in old-line industries must be protected against lead, mercury and other poisonous chemical elements.

So far as now known, no human being has yet suffered from this disease, but its existence and its effects have been demonstrated through animal experimentation. Dr. Austin M. Brues, of the Argonne National Laboratory (formerly the famous Metallurgical Laboratory at Chicago where the first chain reaction was performed) reported the experiments and the danger to the conference on medicolegal problems sponsored by the Institute of Medicine of Chicago, the Chicago Medical Society and the Chicago Bar Association.

The acute form of plutonism is like the acute sickness that comes when the entire body is irradiated with X-rays or radium. In addition there is gross liver damage and shrinkage of the spleen. When injected into the veins, the chemical is at first concentrated in the liver and spleen and later is transferred within the body to the bones.

Within a year after plutonium is injected under the skin, tumors may appear at the site of the injection. Loss of hair, ulcers, and loss of limbs are other effects.

Reinvestigating radium, Dr. Brues and his associates found that it not only causes bone cancers but also produces heavy calcification of the middle coats of the larger arteries.

Yttrium, radioactive cerium and strontium were among the other dangerous atomic fission products investigated.

Plutonism Treatment

➤ A TREATMENT for the new atomic age disease, plutonism, has been discovered at the Argonne National Laboratory. Encouraging results in the preliminary trails are reported by Dr. Jack Schubert, now at the University of Minnesota Medical School.

The treatment consists in displacing the poisonous radio-element, plutonium, from the body by injections of a harmless metal, zirconium.

While no one has suffered from plutonism so far, scientists worry lest it become a health peril to atomic energy workers, like the radium poisoning that struck watch dial

painters after the first World War. The hazards of plutonium poisoning are much greater than those of radium poisoning because of the relatively large amounts of plutonium available and the greater numbers of persons exposed to it.

Plutonium and many other long-lived radio-elements which find their way into the body are deposited mainly in the skeleton. An appreciable amount of plutonium also gets into the liver and spleen. Zirconium acts first to displace plutonium from the liver. Later the zirconium migrates to the bones and slowly but continuously displaces the plutonium deposited there, driving it out of the body. The extent to which it does this depends on the amount of zirconium in the bones in relation to the amount of plutonium.

The encouraging results with zirconium were obtained in studies with dogs and rats. Further studies are under way to determine its effectiveness in radio-yttrium poisoning and other radio-elements.

Dye for Atomic Bleeding

➤A BLUE DYE may save thousands of lives in the event of any future atom bombing. It is called toluidine blue. Its potential value was discovered by Drs. J. Garrott Allen and L. O. Jacobson, of the University of Chicago, in studies made under contract with the Manhattan Project.

The dye might save those survivors of an atomic attack who were having the bleeding stage of radiation sickness. A considerable number of Hiroshima and Nagasaki survivors succumbed a few weeks after the bombing from the infection promoted by this internal bleeding. Even without the blue dye they might have been saved, American doctors think, if they had gotten blood transfusions and penicillin.

Patients with acute leukemia and certain other blood disorders may also get significant temporary benefit from the dye so far as the bleeding in such illnesses is concerned.

The cause of the bleeding that comes in persons exposed to near-fatal doeses of ionizing radiations such as those from the atom bomb is an excessive amount of heparin in the blood, the Chicago doctors find. Heparin is an anti-blood-clotting substance normally present in the liver. It is used medically to counteract a tendency to dangerous blood clots. Too much of it makes the blood clot very slowly or not at all. Fatal bleeding might result.

A dog suffering from radiation sickness like that seen in the Japanese after Hiroshima and Nagasaki had blod that took more than 48 hours to form a clot when a bit of it was tested in a glass tube. The clotting time returned to normal within 20 minutes after the blue dye was injected into its veins.

Neither vitamin K, the anti-bleeding vitamin, nor vitamin C nor calcium salts nor blood transfusions prevented hemorrhage or stopped it in the irradiated dog. But the dye controlled the bleeding.

Damage to Brain

➤ BETA RAYS, which are among the products of atomic fission, can do serious damage to the tissues of the

brain. Dr. Rosalind Novick of the University of Minesota School of Medicine reported to the meeting of the American Association of Anatomists.

She had made a close examination of injuries done to the brains of cats by beta rays given off by radium. The injuries were in sharply limited spots, with zones of decreasing severity as the distance from the ray sources increased. At the center there was dead tissue, then a zone of shrunken and darkened nerve cells, then cells that were acutely swollen, and finally uninjured tissue.

Deformed Babies Century Hence?

➤ EVERYONE alive in the world when the atomic bombs fell on Hiroshima and Nagasaki may be dead before it is known definitely whether Jap babies are going to be born deformed or abnormal because of A-bomb damage to their parents' germ-cells.

The effects of such damage may not show up for several generations. At 20 years to the generation, it may be 100 years before abnormalities, if they do occur, will appear in descendants of the atomic bombing survivors.

This is because the changes, or mutations, which irradiation can bring about in some species of life, such as fruit-flies, are in most cases recessive and may go undetected for several generations.

The fact that some deformed babies have been born in Japan since the A-bombing does not mean that the deformities or abnormalities were the result of the bombings. Members of the Atomic Bomb Casualty Commission, who have just completed a special study of the situation in Japan, found no more cases of such abnormalities than would be normally expected. In any population, it was pointed out, there are always a certain number of individuals born who are not fully normal.

Sterility of a temporary nature apparently occurred, the Commission found from autopsy studies made on those who died within a few weeks after the bombings. Whether any survivors will be permanently sterilized cannot be determined yet.

Starvation and infectious diseases are sterility factors which were present at the time of the bombings. If sterility does occur, it may be difficult or impossible to determine the part played by these factors and the part played by radiations from the bombs.

Members of the Commission were: Dr. Austin M. Brues of the University of Chicago and the Argonne National Laboratory; Dr. Paul S. Henshaw of the Clinton Laboratories, Oak Ridge, Tenn., Lieuts. Melvin A. Block and James V. Neel (MC), U. S. Army, and Lieut. (j.g.) Frederick W. Ullrich (MC) USNR.

Concrete affords such a degree of protection that a person within a concrete building 500 meters (slightly under one-third of a mile) from the ground center of the explosion fared no worse, on the average, than a person standing in the open 1,400 meters distant from the blast.

A large number of burns suffered by the victims, the Commission found, healed with the accumulation of large amounts of elevated scar tissue, called keloids. Whether these are forerunners of cancer and why they occurred are unanswered questions.

Recovery of Fertility

➤ To a chronically atom-jittery world there may be some significance in a report on the partial recovery of female mice after sterilization with X-rays, presented to the American Association of Anatomists by Dr. J. M. Essenberg of the Chicago Medical School.

As is well known, one of the worst effects of the intense burst of radiation, including X-rays, given off by an atom-bomb is the damage to sex glands that renders both men and women sterile, at least for a time. How much time is required for recovery or even whether recovery occurs at all in some cases, has not yet been determined, nor is it known what treatment is called for in such cases.

Dr. Essenberg began his investigations on a mouse-sized scale. He exposed a number of young female rats to X-rays in doses heavy enough to cause sterilizing damage to their sex glands. Into the bodies of some of them he made a series of implants of bits of pituitary gland, which is a ductless gland in the head, whose secretion normally promotes the development of sex glands. To others of the sterile mice he gave a commercial preparation of such a sex-gland-promoting substance.

Examination of the ovaries of the sterilized mice thus treated showed some signs of resumption of normal function, though not full recovery. Further work will be required to determine if full recovery is possible under such treatment.

Silicosis Conquered

➤ Silicosis, once great hazard to the health of industrial workers, is no longer a threat.

In one research project involving 28 plants, having operations using millions of tons of dangerous silica, only three plants were found to have silicosis hazards, and these hazards were readily overcome.

This triumph of scientific research to protect workers' health was announced by Dr. F. R. Holden, W. C. L. Hemeon and T. F. Hatch of the Industrial Hygiene Foundation at its meeting in Pittsburgh recently.

"The dangerous trades of our fathers have all but disappeared," they reported.

Potentially poisonous dusts, fumes and gases can and are being used every day in modern industry without danger.

"Dust control continues to occupy the major place in the entire array of industrial health problems with which we are concerned," the scientist stated. "It is necessary to distinguish between the silicosis dust problem in industry and the far more common nuisance dust problem. Not infrequently we find nuisance dust exposures to be more injurious to the mechanical equipment than to workmen. Good progress has been made in research directed toward more exact measurement and identification of different kinds of dust."

One Mystery in Photosynthesis Reported Solved by Chemists

How Chlorophyll Holds Energy

➤ ONE OF THE mysteries of photosynthesis has been solved by University of California chemists. They have shown how chlorophyll holds on to light energy long enough for it to be stored in plants as sugar, starches, and other substances.

Photosynthesis is the process whereby nature maintains all life on earth. In this process carbon dioxide and water are combined, with the help of chlorophyll, the green pigment in plants, into the energy substances such as sugar.

The Berkeley scientists have shown that chlorophyll has a phosphorescent quality. Earlier they had demonstrated that phosphorescing molecules are in a magnetic state. The shining of a light on these molecules literally boosts them up to this state, and they retain the light until they lose their magnetism.

This fundamental principle, one of the last scientific contributions of the late Prof. G. N. Lewis, was demonstrated by suspending a fluorescein-containing glass between the poles of an electro-magnet. A strong light thrown on half of the glass made it swing quickly toward one of the poles, showing the fluorescein molecules had been magnetized.

Dr. Melvin Calvin, associate professor of chemistry on the Berkeley campus, who had been collaborating with Prof. Lewis, carried the work over into photosynthesis. He found that the phosphorescent state in chlorophyll lasts for about a tenth of a second, about 10,000,000 times as long as the non-phosphorescent state retains light. Thus there is plenty of time for the conversion of this light energy into the many organic energy substances found in plants.

Dr. Calvin says the research provides scientists with one of the missing links in determining all the steps involved in the complicated photosynthetic process.

Dr. Michael Kasha, research fellow in chemistry, and Gus Dorouch, graduate student, assisted Dr. Calvin in the research.

Anti-Bacterial Fatty Acids

➤ THE LOWER fatty acids, chemical building-blocks of common oils and fats, develop anti-bacterial properties on exposure to light and air, apparently through the splitting of their molecules into still smaller units with their atoms strung in shorter chains. This new information is contained in the annual report of Dr. H. A. Spoehr and associates, of the Carnegie Institution of Washington's division of plant biology. In general, the acids made up of bigger molecules are less effective against bacteria than those of smaller molecular weight.

➤ KERATIN *from chicken feathers makes this wig and keeps the quill's original color.*

Rhode Island Red-Head

➤ BEAUTIFUL blonde, brunette and red-head wigs for show-window manikins have been made experimentally from chicken feathers without dyeing the fibers. The natural color of the feathers determines the exact shade of the finished wig.

Not the fluffy feather tips, but keratin in the quills, is used in making the silky fiber. The feathery barbs are first stripped off, then the quills are treated with an alkaline salt of an alkylbenzene sulfonate. The solution is then passed through a fine-holed nozzle into a coagulating bath, where the individual fibers harden.

The process for making the fiber from chicken feather protein was developed at the U. S. Bureau of Agricultural and Industrial Chemistry's Western Regional Laboratory at Albany, Calif. This fundamental re-

search is being conducted in an attempt to find a profitable use for some of the keratin material found in approximately 175,000,000 pounds of chicken feathers that are usually wasted each year.

Chief obstacle in the way of using these fibers for textiles is that they absorb water and are much weaker when wet. But continued improvement in the wet strength of fibers from feather keratin is predicted through use of fundamental studies of the molecular structure, and chemical and physical properties of keratin. When a fiber having sufficient wet strength is developed, it is expected to have many uses.

Detector for False Foliage

➤ POOR IMITATIONS of nature used to hide troops and military equipment can be spotted with a camouflage detector which uses filters to distinguish nature's works from man-made camouflage.

W. A. Shurcliff and E. I. Stearns of the American Cyanamid Company, during the course of research on developing a green camouflage pigment resembling natural chlorophyl, discovered a way of detecting camouflaged areas which do not resemble green vegetation in every respect.

Early in the war, before the importance of using camouflage which properly reflected infrared radiation was recognized, pigments were used containing Prussian blue and even, in some olive drabs, carbon black. These pigments do not have the same reflectance power as the chlorophyl of growing plants.

An optical sighting instrument was designed through which an observer watched the landscape. A pair of red-hue filters were alternately moved into the line of sight at one-half second intervals. Red was chosen in order to lessen the effect of atmospheric haze. One of the filters had a slightly different spectral transmission from the other. The effect was that a continuous red-hued scene was in view as long as natural scenery was present, but as soon as a low-absorption camouflage was in the scene it appeared black through one filter and still light red through the other. The flickering filters made the camouflaged area blink from red to black like a signal. The shadow areas appeared a steady black.

The big advantage of the small, 4.5-pound instrument is that it eliminates the human factor of color judgment and the blinking camouflage calls the attention of the observer to itself. It will have commercial uses for comparing colors of samples, for checking light sources, and for measuring light detectors—including the human eye.

The instrument does not work well when used at altitudes so great that color is indistinguishable; nor does it work satisfactorily when the changing seasons leave large brown or dead areas in natural foliage.

It is interesting to note, however, that the same two men who designed this instrument have also developed a green pigment for camouflage which closely resembles natural chlorophyl spectrophotometrically—the basis on which their detector worked.

➤ NINETY-FIVE *percent nothing makes this silica powder so easily dispersed.*

New Silica Adds Luster

➤ DESIRED LUSTER of varnishes and lacquers can be obtained with the use of a new very highly pulverized silica revealed by the Monsanto Chemical Company at Everett, Mass. The material is so fine that there are 500,000,000,000 particles in a cubic inch, it is claimed.

The improved material, known as Santocel, is technically a gloss reducing agent. The individual particles in the varnish or lacquer finish project through the surface and kill the gloss by scattering the reflected light. Not enough roughness is added, however, to affect the feel of the surface.

The silica particles are porous and sponge-like and contain 94% air, it is estimated. They are nearly uniform in size. The new product is made from an older Santocel that contained about 500,000,000 particles per cubic inch, and is made by bombarding the particles against each other with highly specialized equipment.

Chemical Magic

Radish Skin Yields Odd Indicator

by Joseph H. Kraus

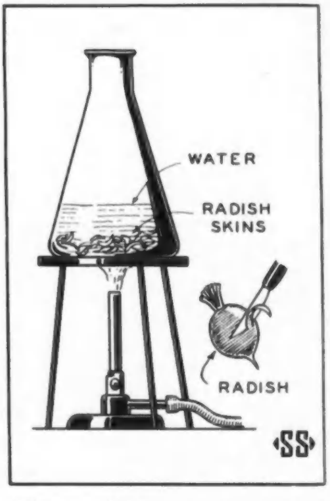
➤ Juice from radish skins is a sensitive chemical indicator. It will produce brilliant colors when an acid or alkali is added to the solution.

From preliminary tests a decoction of radish skins appears to be even more sensitive than the colored liquid resulting from boiling such flowers as blue flag or iris, hydrangea or sumac, any of which will change color when a small trace of acid or alkali is added. It is also more sensitive than juices, such as that of a cherry, or the juice of a red cabbage.

Select about six deeply colored radishes. Wash thoroughly and carefully peel off just the thin skins. You can eat the remainder and probably find that much of the sharpness has been removed with the skins. Put the pared skins in about half a cup of water, preferably distilled or rainwater, and boil until the skins have lost most of their color. Filter and preserve the resulting reddish fluid.

To this liquid add a little acid or acid salt, such as acid sodium sulfate. The smallest quantity of the chemical will make the solution change in color from red to a golden amber.

If you neutralize the solution with bicarbonate of soda, generally kept in the kitchen, it will again take on the original color. If too much bicarbonate of soda is added, however, the red will become much deeper in shade.



There will be variations in the shades of the solutions, probably due to the age or condition of the radish. If a dark color is produced, look out for surface reflections which may appear in a shade of the complementary color.

Now, if to your solution you add a small quantity of acetic acid or strong vinegar, the solution will again take on the yellowish color due to acid.

You may care to make a long list of chemicals that will affect the radish solution and the color it will take on. With a little vacation time on your hands and radishes in season, you might try adding to the radish juice some lemon juice, household ammo-

nia, soap solution, detergents, borax and cream of tartar. You can also try other chemicals usually kept in the kitchen.

Make Test Paper

To make chemical test paper from the radish decoction, immerse a good grade of white blotting paper or filter paper in the liquid, then hang up to dry. Cut into strips about a quarter of an inch wide and two inches long. If such a strip is half immersed in a solution, the contents of which you do not know, you can tell by the color change whether it contains acid or alkali.

Another question worth experimenting with is whether the skins of radishes grown by the sand or water-culture methods would be brown instead of red if the nutrients used tended to be acid. The color of hydrangea flowers can be changed by treating the soil in which the plants grow, so why not the skins of radishes? Thus a whole series of experiments is left open to the young scientist who would like to study color changes.

Chemical "Suckering" of Tobacco

➤ 2,4-D and related growth-control chemicals promise to make it possible to grow tobacco without a great deal of the tedious and costly hand labor now involved in one phase of its cultivation — the job known as "suckering." This promise has developed as a result of experiments carried out by Dr. Robert A. Steinberg of the U. S. Department of Agriculture, at the great federal experiment station at Beltsville, Md.

In growing tobacco, it is customary to decapitate the plants at blossoming time, removing the flowering shoot. This ordinarily stimulates the growth of side branches, or suckers, that spring from buds formed just where the leaf joins the stem. It is now necessary to go through the field several times, picking off these suckers by hand. This is the job known as suckering.

Dr. Steinberg grew several lots of tobacco plants under exactly similar conditions. After topping, he left two lots unsuckered, and kept two lots suckered by hand, in the customary way. The others he treated with a dab of 2,4-D or other growth-control chemical, applied on the cut surface of the stem, after topping.

All the chemically treated groups of plants produced greater weights of tobacco leaf than did the hand-suckered control groups, which in turn outyielded the plants on which the suckers had been permitted to grow. Increases in leaf yield by the chemically treated plants ranged from 11% to 20%. 2,4-D produced the largest yield increase. However, another chemical, alpha-2-chlorophenoxypropionic acid, came within a fraction of a per cent of tying its performance.

These results were obtained in a relatively small-scale experiment. The method will be applied on a full field scale this season, with two kinds of tobacco, to decide whether hand suckering can be supplanted by chemical growth-control in commercial tobacco production.

Same Food to Gain or Lose—
Adaptation of Basic Seven

Food for Health at All Ages

by Jane Stafford

➤ A Basic Seven food plan for persons trying to lose weight has been worked out by scientists of the U. S. Bureau of Human Nutrition and Home Economics. It is a companion to the Basic Seven food plan for good nutrition which these scientists have previously given. Housewives following the original plan in making menus for the family will find it easy to adapt it slightly to the needs of the family member on a reducing diet. For him, or her, the daily diet is based on the following:

1. Skim milk, one pint.
2. Egg, cooked without fat—in shell or poached.
3. Lean meat and fish, such as beef, lamb, chicken, veal, heart, liver; or cod, haddock, perch.
4. Potato—plain boiled or baked and served without butter, but not fried.
5. Vegetables, such as asparagus, snap beans, broccoli, cabbage, cauliflower, greens of all kinds, squash, tomato, turnips—without butter or cream sauce.
6. Fresh fruits in season, without added sugar, cream or pastry.
7. Bread or cereal, small size serving.

Avoid the following: fats, including salad oil, cooking fat, and fat on meat (and don't substitute mineral oil); fried foods, gravies and rich sauces; pastries, cake, cookies, rich desserts, nuts; candies and jellies.

Everyone, whether fat, thin or in-between needs the same basic foods, the scientists explain. Those who want to lose weight should avoid foods that offer extra calories but little or no protective value in protein, minerals or vitamins.

Home gardeners will find the Basic Seven food plan a helpful guide in deciding what vegetables and fruits to plant this spring. This plan divides the foods we eat into seven groups according to their nourishing qualities. One group, for example, is made up of foods that can be the mainstay of the diet for vitamin A. This is the leafy, green and yellow vegetable group which includes spinach and kale, green peas and lima beans, snap beans, and carrots. The Basic Seven plan also tells how many servings from each group should be eaten daily to make up a nourishing diet for the day. One or more servings from the leafy, green and yellow vegetable group are advised.

Two others of the Basic Seven food groups can come from the family garden. One of these is the vitamin C rich foods from which one or more daily servings should be eaten. You can't, unless you live in Florida or California, have oranges and other citrus fruits in your garden, but you can have such other vitamin C fruits as melons and strawberries. And you can have tomatoes, cabbage, turnips, salad greens, and green peppers. Any

of these provide vitamin C when served raw and tomatoes provide it raw or canned.

The third Basic Seven group that can come from the home garden is a catch-all group. It includes potatoes, beets, onions, turnips and radishes. These foods do their part in nourishing you by adding to the supply of various vitamins, minerals and other materials the body needs. Some of them add flavor that makes you want more of the other foods. Beets and turnips yield double harvests in their roots and their fresh green tops. You can add the green tops to your leafy vegetable group. Two or more daily servings from this third group are called for in the Basic Seven plan.

Fat is Well Digested

➤ A GOOD MANY persons, doctors and laymen alike, believe that fatty foods are indigestible. The facts, however, show quite the contrary, as the Journal of the American Medical Association recently pointed out.

The digestibility of fat is ordinarily measured by comparing the amount taken into the body with that lost from the body in the stools. The difference with certain corrections gives the amount digested and absorbed. On a percentage basis, the digestibility of fat is usually above 95.

Both animal and vegetable fats are highly digestible and so are hydrogenated fats, various scientific studies have shown. Even babies can digest and absorb fats efficiently. As long ago as 1925 it was reported that the fat in oleomargarine is more than 95 per cent digested and recent findings show that the fat in the newer vegetable oil margarine is just as digestible for humans as the fat of butter.

Heating fat for deep frying, as for doughnuts and french fried potatoes, has little if any influence on its digestibility.

The reason for the general notion that fatty foods are indigestible is probably, the medical journal states, the fact that fats have a high satiety value. You feel full longer after a meal rich in fat than after eating other foods. This is because fat slows the emptying of the stomach, but that does not mean that fat is poorly digested.

Fat is the richest source of food energy, yielding over 250 calories per ounce, a point to remember if you are trying to gain or lose weight. And you need some fat in order to get certain vitamins.

Well-Grandpa Clinics Coming

➤ WELL-GRANDPA and grandma clinics may be on their way. They would be the equivalent for the old folks of the well-baby clinics to which for many years mothers have been taking their babies at regular intervals. At the well-baby clinics the young ones are weighed and measured and examined. Mother tells doctor whether she has been having any trouble getting the baby to eat or to behave properly. Doctor gives advice on diet, habit training, how to keep baby well. If any physical defects or ailments are found, proper methods of correction are suggested.

At the well-grandpa and grandma clinics the procedure would be somewhat similar. The weekly or monthly measurement of height would not be necessary, nor would the old folks be likely to get "shots" to prevent them from "catching" diseases. But they

would be weighed and examined carefully by the doctor. Suggestions on diet, on remedying of defects and ailments from poor eyesight to cancer, and on living habits would be made.

Signs that such clinics may be coming are seen in the increased interest in problems of aging now being taken by health and medical authorities. Another sign is the establishment within the Indiana State Board of Health of a division of adult hygiene and geriatrics. This is like the divisions of child hygiene and pediatrics which many state health departments have now.

People who are growing old do not have to be senile, that is, feeble in mind and body, any more than children have to have rickets, Dr. William F. King, director of the new division, points out. Helping men and women who are living longer to live better is, he says, the objective of his division.

Blood Chemical Binds Iron, Copper

➤ Two new chemicals from the blood, that doctors may use some day to cure ills, were announced recently by Dr. Edwin J. Cohn of Harvard, famous for his blood plasma researches.

Green, not red, was one of these blood fractions when Dr. Cohn added a copper solution to the colorless fluid demonstrated.

Alone among the 25 known chemicals of the human blood plasma this particular chemical binds either copper or iron firmly to itself to transport these elements through the body.

It is a bright, Valentine's-heart red when it is carrying iron, instead of copper.

"It is my job to make these chemicals from the blood available," Dr. Cohn explained. "It is the task of physiologists and physicians to discover what role they play in the body and how they can be used to treat sick patients."

Already some of the blood fractions isolated and made available by Dr. Cohn and his coworkers are fighting disease.

Little children are being protected against measles by injections of one of the blood chemicals.

Sufferers from hemophilia, the hereditary bleeders' disease called the "curse of the Hapsburgs," may be helped by another.

Better treatments of anemias and other blood diseases are being explored with other blood chemicals.

The new iron-copper carrying blood chemical is known as beta one globulin, or fraction IV-7. It is one of the chemicals obtained as a sort of by-product to the war-time production of serum albumin for transfusion to the wounded. First obtained in a mixture of other blood chemicals, it has now been obtained in crystalline form as a single chemical. Dr. Bernard Koechlin, working in Dr. Cohn's laboratory, was responsible for this advance.

The other new blood chemical separates from human serum albumin as a mercury salt. This was obtained by Dr. W. P. Hughes, Jr., another of Dr. Cohn's associates at Harvard.